The Journal

OF THE

AMERICAN ASSOCIATION OF NURSE ANESTHETISTS

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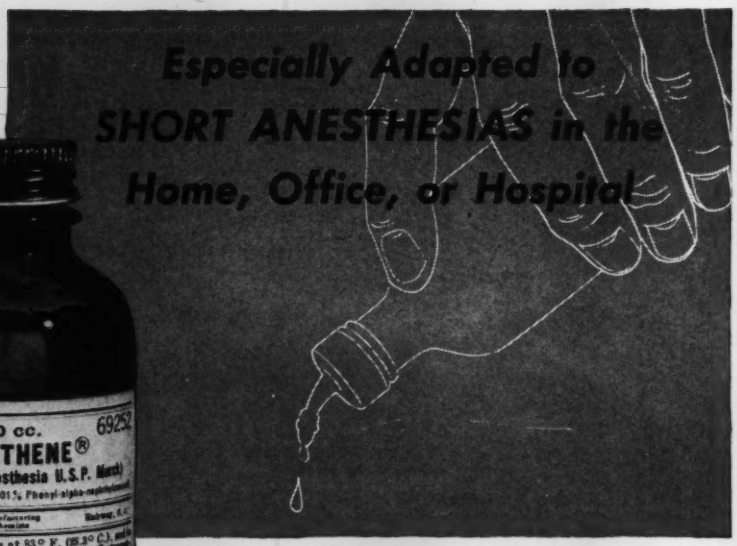
1. Goodman, L., and Gilman, A.: *The Pharmacological Basis of Therapeutics*, New York, The Macmillan Co., 1947, p. 58.



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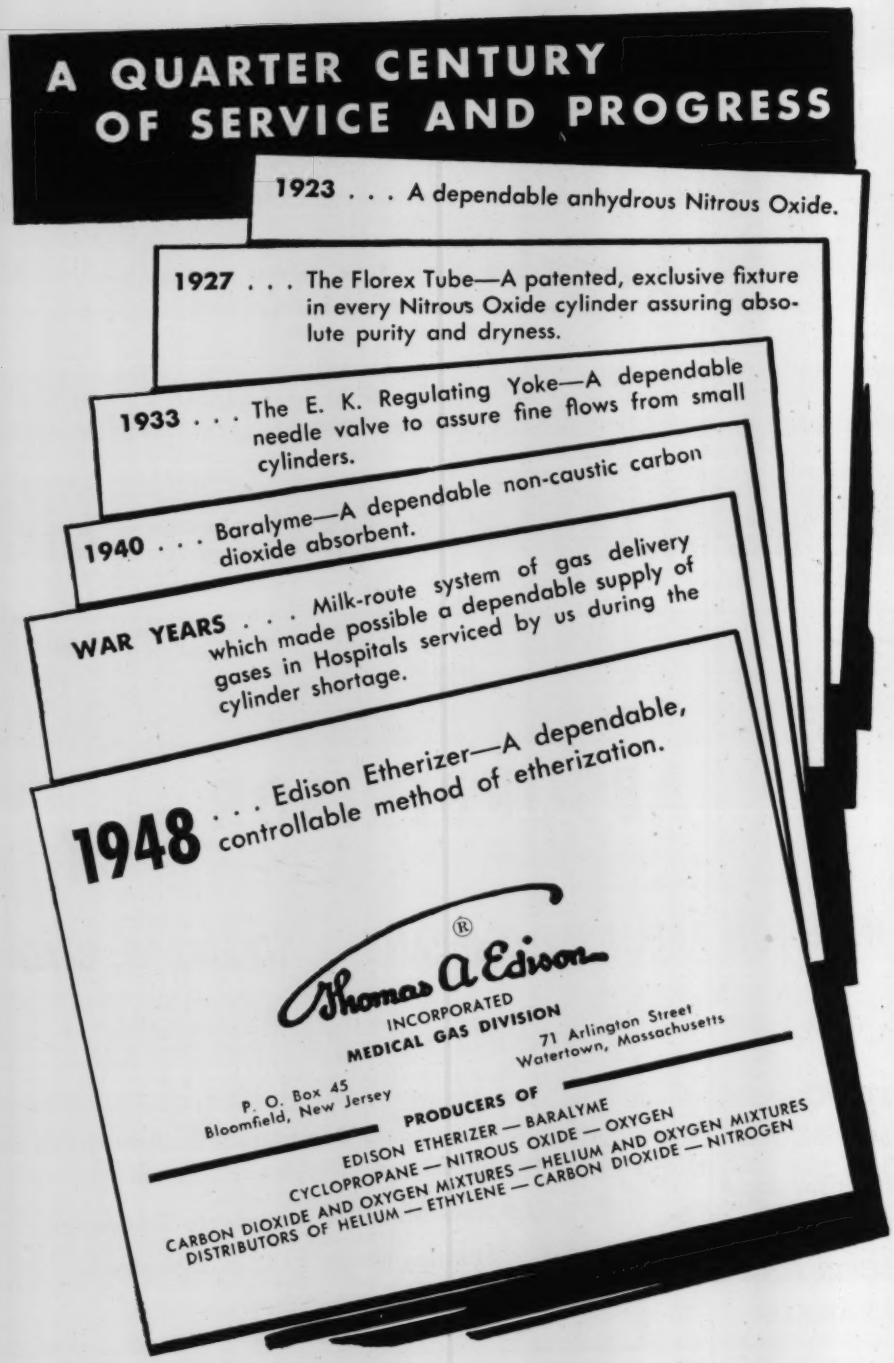
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The Journal of the American Association of Nurse Anesthetists

VOLUME XVI AUGUST, 1948 NUMBER THREE

A.A.N.A.: Past, Present, and Future

Lucy E. Richards, R.N.*
Cleveland

When forty-nine nurse anesthetists from twelve states met at Lakeside Hospital in Cleveland on June 19, 1931, to form the National Association of Nurse Anesthetists, they had a reason. Agatha Hodgins, the driving personality behind the Association and its first president, stated the reason thus:

"Basically, the reason for organization was a deepening consciousness, in the minds of those most concerned, of the accepted truth: that the development of any field of work is best obtained by organizing into a coherent group those most concerned with its continuance and progress . . . . Forming . . . such an organization implies not only commitment to certain ideals but involves the responsibility of working in a definite practical way for the attainment of desired objectives."

In Miss Hodgin's statement there are three phrases full of meaning for all Association members today: "commitment to certain ideals," "responsibility of working," and "the attainment of desired objectives."

In the professions, particularly, that word "ideals" has been bandied about until it has lost much of the inspiration of its original meaning. Ideals should not be lifeless, abstract, and way off somewhere. For us nurse anesthetists, a commitment to certain ideals should mean a commitment to the highest vital concept of what the nurse anesthetist should and can be. How often we older anesthetists say to ourselves and to our contemporaries: "It didn't use to be like this. What is happening to us and our profession?" Once we were able to think first and only of the patient. We were willing and sincerely desired to expend unlimited time and energy as women and nurses to give the patient of ourselves. Today we find ourselves as nurses and anesthetists infected by the confusion that is spreading through all the professions—confusion from economic insecurity and confusion from professional insecurity. Ideals are getting second best attention. They have little chance to grow and develop. Today ideals are overshadowed by the philosophy of "If I don't toot my own horn, no one else will. I'm going to get while the getting is good." I do not mean

Read before the Minnesota Association of Nurse Anesthetists, Minneapolis, June 3, 1948.
*President, American Association of Nurse Anesthetists.

that present-day problems of insecurity are to be ignored. I do mean that we must preserve standards and recapture the inspiration of ideals. And we must use these standards and ideals as guides in the solution of our economic and professional problems.

A case in point is the anti-nurse anesthetist publicity that had become flagrant in the lay press during the past two years. The Board of Trustees was bombarded with letters from the members asking that something be done, that the Association retaliate with an intensive publicity campaign. However, equally strong opinions were expressed by those who believed that inaction was the proper course to take. After hours of investigation and discussion, your officers took a middle course. In this instance, whether as a result or as a side-effect of the Board's decision, our tormenters have been chastized by their peers, and we have maintained our professional integrity.

Every association is the better for members who covet position. But in seeking and holding office, how many of us seriously consider the "responsibility of working?" You may say that someone must have worked to build an association of 4,000 members with thirty-two state organizations and an active educational program. True, much has been accomplished. Yet can we say that the most or even an average amount has been accomplished? The key to the difference between the least and the most in achievement is to be found in that word "work."

Work means not only doing but learning to do better. It means taking time to study procedure. It means taking the time to find out what has been proposed, as well as what has been accomplished, in the past, and applying that knowledge to the present and future situation. Work means striving to see the other fellow's viewpoint. Work means finding ways of effecting a compromise, of giving up or maintaining the status quo, at the loss of personal prestige but for the long term benefit of the profession and the Association. Work means providing practical means for the education in Association affairs of young anesthetists to give them a broad view of the past so that the future may have stability. The responsibility of work means not only attention to detail and routine but to the nuturing of ideas so that they are realized, not just talked about. True, much has been accomplished in the seventeen years of our existence as an association. But we could and can accomplish more, by being willing to change our present procedures, by broadening our knowledge, and by examining and changing our ideas in the light of the past, the present, and the future.

As stated in the Articles of Incorporation, our objectives are: "to advance the science and art of anesthesiology; to establish standards and technics for the administration of anesthetics; to promote co-operation between

nurse anesthetists and the medical profession, hospitals, and other agencies interested in anesthesiology; and to publish periodicals and bulletins and to sponsor an educational program with the object of disseminating information concerning the proper administration of anesthetics."

How far have we gone in realizing these objectives? If we analyze them, we find that all point to the attainment of the first: "advancing the art and science of anesthesiology." This in turn means just one thing: it means increasing the excellence of service of the *individual* nurse anesthetist to patients, surgeons, and through them to society. To this end, what have we as an association accomplished?

In 1933 the first *Bulletin of the National Association of Nurse Anesthetists* was published, and since that time has had an unbroken record of publication. To Gertrude Fife should go the credit for starting this publication and for being persistent enough to demand that it take its rightful place among specialty journals. A year ago we employed a full-time editor and are confident that the JOURNAL now holds and will continue to hold a respected position as one of seven anesthesia journals now being published in the world. Within the last year we have expanded the publications program to include a quarterly NEWS BULLETIN, and through this medium we plan to keep Association members better informed about Association affairs.

1945 was the year that the examination program was initiated, and by April of this year seven examinations had been given. By this program alone, we have been able to raise standards of membership. We have been able to raise the educational standards in the schools of anesthesia and to increase the excellence of service of *individual* nurse anesthetists to patients, surgeons, and society. This program was put into action by the hard work of a number of members, among whom outstanding contributions were made by Gertrude Fife, Miriam Shupp, and Helen Lamb.

In 1946, the Association sponsored its first Institute for Nurse Anesthetists. Esther Myers Stephenson, as you well know, has ably promoted the idea, and in this project we have had the full co-operation of the American Hospital Association.

This year, Marie N. Bader has brought to completion a project for permanent display materials for our educational exhibits. This year, through the efforts of Myra VanArsdale, we secured the initial funds for a program of financial aid to anesthetists who wish to prepare themselves to teach. This year, the Association has retained Mr. Emanuel Hayt as legal advisor, and his services are available to every Association member. And this year, we have laid the groundwork for increasing our service to members and regional organizations from our headquarters office, by placing it under the able direction of Florence McQuillen.

Yes, something has been accomplished, but in the light of what is still to be done, we should be humble. For the projects already started, we must have greater interest and support. If the JOURNAL is to give nurse anesthetists the kind of theoretical information that they want and need, our members are going to have to sit down and express their needs and ideas to the editor in writing. To share their knowledge, they are going to have to take the time and do the work required to prepare articles.

If the examination program is to develop along the right lines, individual members must take an interest in it, talk about it, write about it, and support it. The examination program is not the concern only of the schools, the Examination Committee, and headquarters; it is the concern of every member, for by the examination program is determined who shall and who shall not be a member of our association.

The scholarship program not only needs money, but it needs deserving anesthetists who wish to teach to use that money. We as an association must encourage more anesthetists to prepare themselves to teach, for unless we have more and better prepared teachers, we will not have more and better prepared anesthetists in the field.

The institutes program must be expanded to reach more anesthetists at less cost. There is a tremendous demand for institutes, and, as your group has so ably demonstrated, they can be conducted on a regional as well as a national basis. The national Association must and wants to help regional groups bring to their members refresher courses through this medium.

Now what about the future? We must maintain and improve what has been accomplished in the past. That work is never finished. But in addition we must put into effect new programs, the most important of which is the approval program for the schools of anesthesia. The idea for an approval program is fully ten years old. During those years, the Education, Examination, and Curriculum Committees have laid the groundwork. There is evidence that much could have been done on the approval program that has not been done. On the other hand, much could also have been done that would require radical revision in the light of new developments. In substance, we now think we are on the right track.

During this discussion, you may have noticed that no mention has been made of one objective. That objective is "to promote co-operation between nurse anesthetists and the medical profession, hospitals, and other agencies interested in anesthesiology." That is our big new goal for the future. Thus far, the American Association of Nurse Anesthetists has grown in two directions: (1) in the direction of developing the individual nurse anesthetist to give the

(*Continued on page 225*)

ANESTHESIA FOR THE SURGICAL TREATMENT OF TETRALOGY OF FALLOT

Pauline Hensley, R.N.*
Dallas, Texas

Among the congenital abnormalities of the heart now amendable by surgery are patency of the ductus arteriosus and tetralogy of Fallot.

The anomalies comprising the group described by Fallot in 1888 and termed the tetralogy of Fallot are stenosis of the pulmonary artery, interventricular septal defect, dextroposition of the aorta, and hypertrophy of the right ventricle.[1,2]

Patients with this anomaly are usually underdeveloped, undernourished children in whom cyanosis is present in varying degrees. Tolerance of physical exercise varies with each patient. Syncopal attacks may be present. There is a compensatory polycythemia. Arterial oxygen saturation is diminished with a corresponding increase in arterial carbon dioxide content. Clubbing of the fingers and toes due to continued oxygen want is present.

Surgical treatment of tetralogy of Fallot was accomplished by Dr. Alfred Blalock[1] in November, 1944. The operation produced an arteriovenous fistula to increase the quantity of blood flow through the lungs for oxygenation.

This group of patients are poor surgical risks, and the necessity for intrapleural surgery with manipulation of major mediastinal vessels adds to the problem confronting the anesthetist.[3] The anesthetic agent must provide two major conditions: (1) a quiet mediastinum to facilitate surgery and (2) maintenance of a high oxygen content in the presence of lowered oxygen saturation and partial collapse of one lung. At Baylor University Hospital, we have found that the two agents best fulfilling these requirements are cyclopropane and ether. In a series of 26 anesthesias for 25 patients several combinations have been tried. In 21 cases cyclopropane was the only agent used; in this group a 2½ per cent solution of pentothal sodium, 350 mg. to 500 mg. respectively, was used as the induction agent for two children, aged 15 years and 14 years. In four cases cyclopropane and ether combinations were employed.

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*Read before the Twelfth Annual Meeting of the Texas Association of Nurse Anesthetists, Dallas, Texas, March 4-6, 1948.

*Member Anesthesia Staff, Baylor University Hospital.

1. Blalock, Alfred, and Taussig, Helen B.: Surgical treatment of malformations of the heart. J.A.M.A. **128**: 189-202, May 19, 1945.

2. White, Paul Dudley: *Heart Disease*, ed. 3 (New York: The Macmillan Co., 1944) 267-323.

3. Harmel, M. H., and Lamont, Austin: Anesthesia in the surgical treatment of congenital pulmonic stenosis. Anesthesiology 7: 477-498, Sept. 1946.

Cyclopropane and ethylene were used in one case, the ethylene being added after the anastomosis was performed.

Premedication

Premedication for these children varies little from that for normal children of the corresponding age group. The same effects of a premedicant are desired: psychic depression, reduction of reflex irritability, and specific effects to counteract unwanted side actions of agents or technics. The first effect is particularly desirable since crying or struggling on the part of the patient tends to produce a greater degree of cyanosis. In this series premedication varied from atropine sulfate, gr. 1/750, for a baby aged 11 months, to morphine sulfate, gr. 1/8, with atropine sulfate, gr. 1/200, for a boy aged 15 years. Premedication was given hypodermically one and one-half hours to one hour before surgery.

Administration of the Anesthetic

With the exception of the use of pentothal sodium in two cases, anesthesia was produced by the inhalation agent. In all these cases cyclopropane was employed for induction for its pleasantness and rapidity of induction and the high oxygen content. Ether was added to the mixture or used exclusively after induction. Oral intratracheal intubation was done by direct vision in 21 of the 26 cases. Postoperative tracheotomy was necessary in two cases, for a boy, aged 3 years, forty hours postoperatively, and for a boy, aged 8 years, twenty-six hours postoperatively. The four patients for whom intubation was not used ranged in age from 11 months to 2 years, and a close fitting mask with the to-and-fro absorption technic was employed.

A cannula was inserted into a vein to insure constant control of the intravenous administration of fluids. A 5 per cent solution of dextrose in distilled water was given, usually at a rate of 15 drops per minute. In the presence of polycythemia whole blood was not given except for severe hemorrhage. To the 500 cc. of dextrose was added one unit of concentrated plasma to prevent surgical shock.

Approximately five minutes before the pleural cavity was opened, atropine sulfate was administered intravenously, the dosage being the same as that given for premedication. Exploration and isolation of the appropriate vessels for the operation necessitates contact with tissues rich in vagal nerve fibers. The prophylactic dose of atropine was adequate to control vagal stimulation in most cases. In nine cases it was necessary to administer added doses of atropine; in one, four injections were given. Whenever bradycardia or cardiac arrhythmia was noted during the operative procedure, the operation was interrupted, the lungs were inflated with oxygen, atropine was administered intravenously, and, if the condition persisted, novocain 1 per cent was injected into the vagus nerve. If cardiac arrhythmia was present when cyclopropane was the anesthetic agent, ether was added to the mixture. These measures

served to stabilize the heart rate in all but two cases.

Respiratory complications during operations were not so frequent as cardiac complications. In those cases in which intratracheal anesthesia was used, aspiration of the trachea was necessary because of the frequency of upper respiratory tract infections characteristic of tetralogy of Fallot. In the four cases in which intubation was not done, frequent "burping" was required to relieve pressure on the diaphragm produced by positive pressure on the breathing bag with resultant gastric dilatation.

Several times during the operative procedure, the operation was interrupted to allow complete inflation of the lungs. This, in conjunction with the use of soda lime canisters for carbon dioxide absorption and frequent emptying of the breathing bag, served to prevent carbon dioxide accumulation. In one case tetanic seizures were observed. Inflation of the lungs with oxygen and the addition of fresh soda lime to the to-and-fro system relieved the seizures. They were believed to be caused by carbon dioxide accumulation.

While the thoracic cavity was open, intermittent positive pressure was used. This usually produced a sufficiently quiet field. On occasion it was necessary to use controlled respiration by increasing the anesthetic agent. Morphine may be given intravenously to control the movement of the mediastinum.

Before closure of the chest wall, the lungs were completely reinflated; then a slight positive pressure was maintained until the cavity was completely sealed.

The majority of patients responded or even cried before leaving the operating room. Administration of oxygen was continued during transportation, and the patient was placed in an oxygen tent in the room. Oxygen was given continuously for twenty-four hours, then intermittently as required by the patient. The venous cannula was left in place twenty-four to forty-eight hours as insurance against a postoperative emergency.

The direct benefit derived from a successful anastomosis was apparent early, frequently within minutes after the clamps were removed. Cyanosis was lessened progressively, the general condition was improved, and within a few days the patients were in wheel chairs. They were discharged ambulatory.

REPORT OF CASES

This series included 25 operations, in 22 of which the anastomosis was done, and in 3 of which anastomosis was not done for anatomic reasons. Twenty-six anesthesias were administered in the series, to one patient twice. The first operation was canceled when pus was aspirated from the trachea after intubation.

Six patients died, one being a child in whom an anastomosis was not done. This was a mortality rate of 24 per cent. (See the table.)

Two of these cases are reported in detail.

Cause Of Death In 6 Of 25 Cases Of Tetralogy Of Fallot Treated Surgically

Case	Sex	Age	No. Hours Post-Operative	Cause
5	M	11 Years	5	Respiratory arrest from massive hemorrhage into right pleural cavity.
7	F	7 Years	Immediately	Convulsive spasm with respiratory and cardiac failure of unknown cause.
8	F	6 Years	10	Cardiac arrest from cardiac failure. (Anastomosis not done.)
13	M	11 Months	Immediately	Unknown.
18	F	2 Years	Before operation was completed	Cardiac arrest apparently from repeated vagal stimulation.
21	F	2 Years	Before operation was completed	Cardiac arrest apparently from myocardial anoxia.

Case 21.—A girl, age 2, was admitted with the diagnosis of tetralogy of Fallot. Laboratory procedures showed a hemoglobin of 23.2 Gm.; 9,870,000 erythrocytes; arterial oxygen saturation 35.9 per cent. Weight was 22 pounds. Physical examination revealed a well developed, well nourished, cyanotic child. There were marked cyanosis and moderate clubbing of the digits.

Codeine sulfate, gr. 1/8, with atropine sulfate, gr. 1/400, was given hypodermically one hour before operation. Cyclopropane was the agent; induction was smooth and rapid. Intubation was not done. A cannula was inserted into a vein for intravenous administration of fluids. Incision was made into the left chest. Previous to entrance to the cavity, atropine, gr. 1/400, was given intravenously. Normal plasma, 100 cc., was added to the 5 per cent dextrose solution and given at a rate of 15 drops per minute. The only difficulty encountered with anesthesia was the inability to produce a quiet operative field. The percentage of cyclopropane was increased, controlled respiration maintained, and the operation continued. Just before the anastomosis was completed, the heart rate suddenly slowed, then became irregular, and within a few seconds ceased. Atropine, gr. 1/400, had been given intravenously at the first sign of bradycardia. Inflation of the lungs was started. Cardiac massage was immediately started, and 0.5 cc. of 1 per cent procaine was injected into the cardiac muscle. All methods to restore the heart beat were unsuccessful.

Autopsy revealed complete atelectasis of the left lung with regional atelectasis and emphysema of the right lung. Myocardial anoxia was the apparent cause of death.

Case 24.—A girl, aged 14, was admitted with the history of cyanosis since birth. As a child she became cyanotic if she attempted any physical exercise. Thirteen months previous to admission she had influenza and after recovery was so weak that she was unable to walk. After that time she remained in bed and grew progres-

sively weaker. Physical examination revealed a fairly well developed, poorly nourished, markedly cyanotic girl. She weighed 83 pounds. Laboratory examination ten days previous to surgery showed a hemoglobin of 20.8 Gm., with 8,140,000 erythrocytes. The arterial oxygen saturation was 25.6 per cent.

Morphine sulfate, gr. 1/8, and atropine sulfate, gr. 1/200, were given hypodermically one hour before operation. Induction of anesthesia was with cyclopropane. Ether was added to the mixture to facilitate intubation. Cyanosis was not lessened with anesthesia even with the use of a high oxygen content in the mixture. Atropine sulfate, gr. 1/300, was given intravenously to decrease laryngospasm. Oral intratracheal intubation under direct vision was performed. A cannula was inserted into a vein, and the administration of 500 cc. of 5 per cent dextrose in distilled water plus one unit of concentrated plasma was started. Morphine, gr. 1/12, with atropine, gr. 1/300, was given intravenously previous to the opening of the pleural cavity. This aided in producing a quiet mediastinum. Forty-five minutes after the pleural cavity was opened, atropine, gr. 1/300, was administered intravenously; mild bradycardia followed with an associated decrease in blood pressure. After four hours of anesthesia, another solution of dextrose and plasma was added. The administration of 500 cc. of whole blood was started after six hours of anesthesia. Profuse hemorrhage had occurred during the operation.

With the completion of a successful anastomosis, a slight improvement in color was noted. The color continued to improve, and when the patient was returned to her room, her skin was pink. She was placed in an oxygen tent. The venous cannula was kept patent by a slow drip of 5 per cent dextrose in distilled water.

The postoperative period was uneventful. Oxygen administration was discontinued at the end of the fourth day. She was in a wheel chair on the eighth day and walked on the eighteenth day. It was necessary to give the patient passive exercises and massage to overcome muscular atrophy. Three weeks after operation, the arterial oxygen saturation had increased to 52.9 per cent. Hemoglobin was 16.25 Gm., with 5,550,000 erythrocytes. The patient was discharged twenty-three days postoperatively. The results of the operation were excellent.

SUMMARY

The anesthesia management for 25 patients undergoing surgical treatment for tetralogy of Fallot has been reported. Various anesthesia problems have been discussed, those cases in which the patient showed clinical improvement have been cited, and the deaths reported.

THE VALUE OF CONTINUOUS ARTERIAL OXYGEN SATURATION RECORDINGS IN ANESTHESIA

Vivian Gould Berhmann, Ph.D.,* and
Frank W. Hartman, M.D.†
Detroit

Although the exact mechanism of narcosis remains controversial, the recent work of Schmidt[1] (1945) and Himwich[2] (1947) on pentothal sodium anesthesia suggests that a part of the narcotic mechanism is a histotoxic anoxia, as demonstrated by depression of cerebral cellular respiration. If this theory of narcosis is accepted, it is obvious that some degree of anoxia may be an inevitable complication of anesthesia. The objective of the anesthetist, then, is to control anoxia within safe reversible limits in order to avoid irreversible pathologic changes, on the one hand, and light narcosis with increased hypersensitivity, on the other.

The successful control of anoxia depends primarily on its early detection. Of the four types of anoxia, the one most readily recognized is anoxic anoxia, i.e., anoxemia. It is caused by impaired oxygenation of the arterial blood at the lungs and is characterized by cyanosis and a generalized oxygen lack in all the tissues of the body. The occurrence of arterial anoxemia during anesthesia has been confirmed by objective observations as well as by chemical analysis. The nurse anesthetist, being well aware of this hazard, has coped with it most successfully through adequate oxygenation of the patient from induction to the end of the period of anesthesia, or she has warded it off through increased oxygen administration at the first change in the blood pressure, pulse, or appearance of her patient.

It is well known that the human eye is subject to error insofar as visual impressions of color are concerned. Color perception varies not only from one person to another but also in the individual response to the same color at different times. Comroe and Botelho[3] (1947) reported that visual impressions of cyanosis are unreliable. They evaluated the ability of observers to detect cyanosis in 20 normal males, subjected to various gas mixtures,

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Read before the Tri-State Assembly of Nurse Anesthetists, Chicago, May 3, 1948.

*Research Associate in Physiology, Henry Ford Hospital; Instructor, Wayne University Graduate School.

†Pathologist and Director of Laboratories, Henry Ford Hospital.

1. Schmidt, C. F.; Kety, S. S., and Pennes, H. S.: The gaseous metabolism of the brain of the monkey. Am. J. Physiol. **143**: 33, 1945.

2. Himwich, W. A.; Homburger, E.; Maresca, R., and Himwich, H. E.: Brain metabolism in man: Unanesthetized and in pentothal narcosis. Am. J. Psychiat. **103**: 689, 1947.

3. Comroe, J. H., Jr., and Botelho, S.: The unreliability of cyanosis in the recognition of arterial anoxemia. Am. J. M. Sc. **214**: 1, 1947.

by a comparison of their color estimations with known arterial oxygen saturations, as obtained photoelectrically with the Millikan oximeter. Cyanosis was not detected by the majority of the 127 observers until the blood oxygen saturation fell to approximately 80 per cent; 25 per cent of the observers were unable to recognize cyanosis even when the arterial oxygen saturation fell to levels of 71-75 per cent. The authors pointed out that serious grades of arterial anoxemia may pass unrecognized by many physicians unless arterial blood is analyzed for oxygen content and capacity.

In view of these data, it is evident that the anesthetist requires instantaneous and accurate information concerning the degree of arterial oxygenation of the patient if she is to fulfil her objective. Chemical analysis, which is a tedious and time-consuming procedure, offers no immediate aid. Consequently, she has had to rely on visual observations until recently. The photoelectric oxyhemograph,[4] described recently, should offer a solution to this problem for the anesthetist in allowing her to supplement observations with an accurate, continuous record of arterial blood oxygen.

It is the purpose of this presentation to describe the development of the oxyhemograph briefly and demonstrate the value of the instrument in the control of anoxemia during anesthesia.

4. Hartman, F. W.; Behrmann, V. G., and Chapman, F. W.: A photo-electric oxyhemograph—a continuous method for measuring the oxygen saturation of the blood. Am. J. Clin. Path. **18**: 1, 1948.

In 1939 McClure and his associates[5] carried out an extensive study of anoxia during surgical anesthesia. The disadvantages of the arterial puncture method led these workers to seek a more facile but still reliable method of measuring the oxygenation of the blood. A search of the literature showed that a photoelectric method, which would depend upon the well known color variation of the blood from bright red toward blue as an indication of decreasing oxygen content, should have great possibilities.

Although the first photoelectric estimation of oxyhemoglobin is attributed to Nicolai[6] (1932), the fundamental work was carried out through the independent efforts of Kramer[7] and Matthes[8] in 1934 and 1935. Kramer recorded variations in oxyhemoglobin *in vitro* and *in vivo*, by the use of a method based on the spectral differences of hemoglobin and oxyhemoglobin in the red wavelength region (620-770 mu). He showed that Beer's law of optical absorption may be applied to hemoglobin solutions and hemo-

5. McClure, R. D.; Hartman, F. W.; Schnedorf, J. G., and Schelling, V.: Anoxia—a source of possible complications in surgical anesthesia. Ann. Surg. **110**: 835, 1939.

6. Nicolai, L.: Über Sichtbarmachung, Verlauf und chemische Kinetik der Oxyhämoglobinreduktion im lebenden Gewebe, besonders in der menschlichen Haut. Arch. f. d. ges. Physiol. **229**: 372, 1932.

7. Kramer, K.: Bestimmung des Sauerstoffgehaltes und der Hämoglobinkonzentration in Hämoglobinlösungen und hämolysiertem Blut auf lichtelektrischem Wege. Ztschr. f. Biol. **95**: 126, 1934. Ein Verfahren zur fortlaufenden Messung des Sauerstoffgehaltes im strömenden Blute an uneröffneten Gefässen. Ztschr. f. Biol. **96**: 61, 1935.

8. Matthes, K.: Über den Einfluss der Atmung auf die Sauerstoffsättigung des Arterienblutes. Arch. f. exper. Path. u. Pharmakol. **176**: 683, 1934. Untersuchungen über die Sauerstoffsättigung des menschlichen Arterienblutes. Arch. f. exper. Path. u. Pharmakol. **179**: 698, 1935.

globin in the red cell. Matthes' contribution was the continuous optical registration of light absorption in different spectral regions, using red light for oxygen content and green light for the total hemoglobin. In 1935 Matthes adapted Kramer's method for closed blood vessels in the experimental animal to human beings, through the use of an ear lobe attachment.

After using an imported Kramer apparatus, Hartman and McClure[9] (1940) developed a one color instrument, which operated in the red wavelength region. This "oxyhemoglobinograph" consisted of a photoelectric colorimeter in which the beam of light passed through the web of the hand. Although the apparatus provided the desired sensitivity for clinical studies, its most serious limitation arose from volume changes in the tissue thickness exposed to the light beam, thus introducing an error.

Other workers[8,10,11,12] have appreciated the disturbance created by volume variations and have attempted to correct for them in their photoelectric methods for blood oxygen determination. Although the technical details vary, all of these methods involve photocell recordings in two spectral regions, one which is sensitive to total hemoglobin (near infra-red, Squire; blue, Goldie; green, Matthes and Millikan), and the other, the red wavelength, which is sensitive to oxyhemoglobin. Squire and Goldie standardized their instruments by rendering the tissue bloodless, whereas Millikan compared the fully flushed ear with an optical filter. Of these three methods, only the Millikan oximeter reached the production stage, and, therefore, it was used extensively in the wartime aviation research program.

The oxyhemograph (fig. 1) has incorporated within it the best features of the technics described in the literature. It is the product of the joint endeavor of workers from the Department of Laboratories, Henry Ford Hospital, and the Research Laboratories Division, General Motors Corporation, Detroit Michigan. The blood oxygen saturation is measured through the use of a bichromatic photocell attached to the ear. A unique feature of the method is amplification by means of a "contact-modulated" D.C. amplifier, which is stable and sensitive and allows a permanent, continuous tracing on a rugged D.C. milliammeter.

The ear unit* contains two miniature photocells, a small lamp, and two color filters. Light transmitted through the ear is measured in two spectral regions. The "red" cell photocurrent is altered by changes in the oxygenation of the blood together

9. Hartman, F. W., and McClure, R. D.: Further anesthesia studies with photoelectric oxyhemoglobinograph. Ann. Surg. **112**: 791, 1940.

8. Matthes, loc. cit.

10. Squire, J. R.: An instrument for measuring the quantity of blood and its degree of oxygenation in the web of the hand. Clin. Sc. **4**: 331, 1940.

11. Goldie, E. A. G.: A device for the continuous indication of oxygen saturation of circulating blood in man. J. Scient. Instruments **19**: 23, 1942.

12. Millikan, G. A.: The oximeter, an instrument for measuring continuously the oxygen saturation of arterial blood in man. Rev. Scient. Instruments **13**: 434, 1942.

*Coleman Electric Co., Maywood, Ill.

with volume variations.* The "green" cell photocurrent is affected by volume variations alone because in this spectral region the absorption characteristics of oxyhemoglobin and reduced hemoglobin are similar. The two photocurrents are opposed to one another, so that changes due to volume variations are canceled out, allowing only the signal measuring an oxygen change to be emitted. This difference signal is changed to alternating current, is amplified, rectified, and sent to a milliammeter which makes an ink record of blood oxygenation.

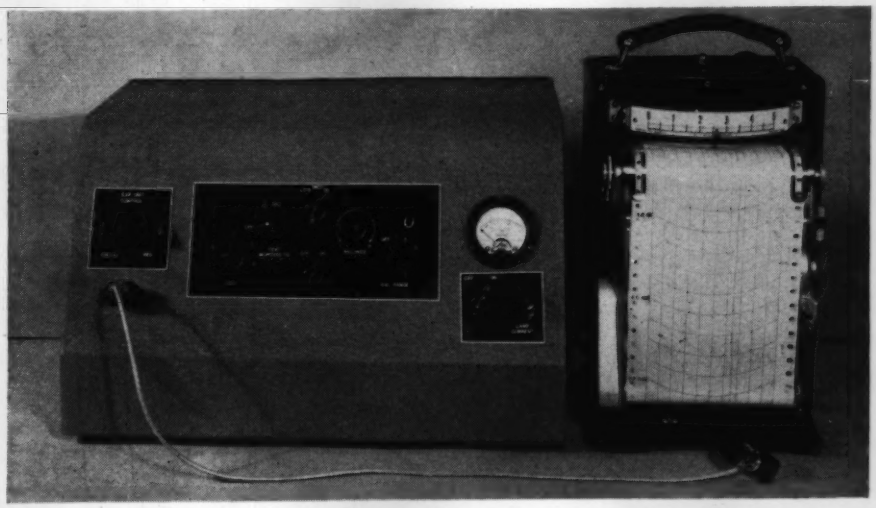

Fig. 1.—The oxyhemograph, comprised of the photocell earpiece, the amplifier, and the recording milliammeter.

The instrument is calibrated by correlating actual arterial blood oxygen saturation values with the oxyhemograph readings (fig. 2). The blood is analyzed in duplicate for oxygen content and oxygen capacity, using Van Slyke's manometric method. The per cent saturation is computed from these figures. Data obtained on 20 patients under pentothal sodium-nitrous oxide-oxygen anesthesia show that the chemical and instrumental data are usually within $\pm 2\frac{1}{2}$ per cent. The conformity of the blood values and the oxyhemograph is proof of its reliability.

The sensitivity of the oxyhemograph allows a study of the fluctuations in the oxygenation of the blood associated with the respiratory cycle. This is demonstrated not only in the experimental animal (fig. 3) but also in the anesthetized human being

*The expression "volume variations" includes four variables: (1) tissue thickness which affects the amount of light absorption by the tissue itself; (2) extent of the capillary bed which affects the amount of blood in the optical path; (3) total hemoglobin which affects the amount of hemoglobin in the optical path; (4) vasomotor changes, caused by fluctuations in blood pressure, which would affect factor (2), and associated at times with a redistribution of hemoglobin, as may occur in shock, which would affect factor (3).

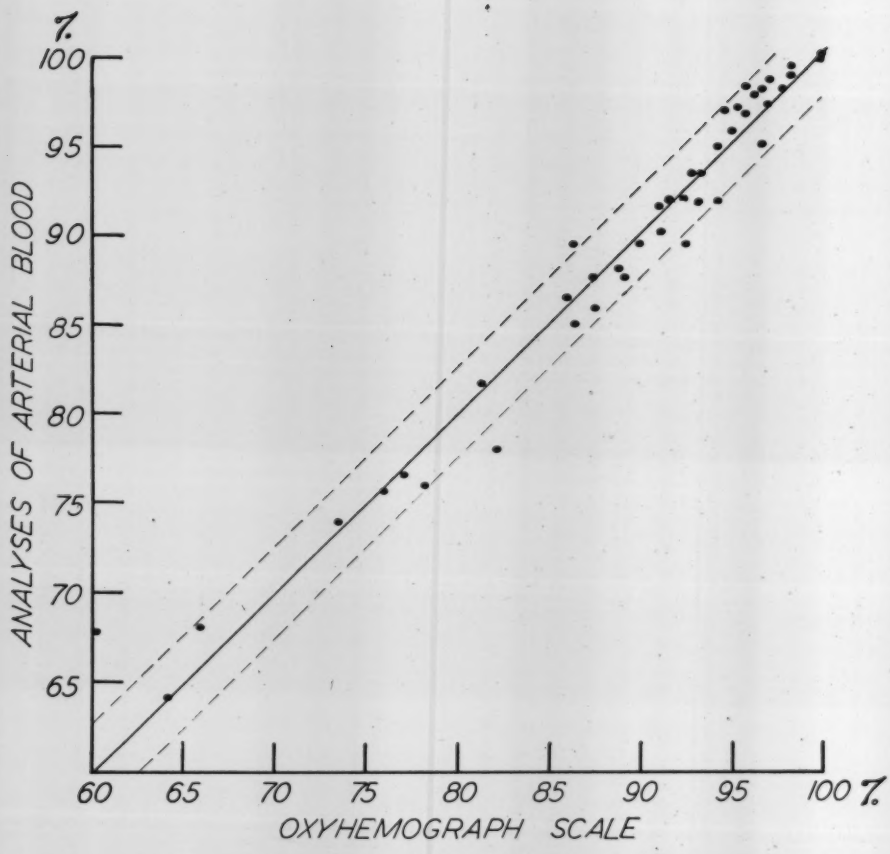

Fig. 2.—Correlation between the chemical and instrumental values for the blood oxygen saturation in per cent. Identical values fall on the solid line. Twenty-eight out of 42 points (66.6 per cent) lie within ± 1 per cent. Those points (39 out of 42 or 92.8 per cent) included within the broken lines represent an agreement of ±2½ per cent. The remaining points (3 out of 42 or 7.2 per cent) are within 3-8 per cent.

(fig. 4) during slow respiration. Such a rapid response should make the instrument a boon to the anesthetist, for the first warning of developing hypoxemia is registered far in advance of clinical symptoms.

The current widespread usage of intravenous anesthesia, together with the variance of opinion as to the necessity for coincident oxygen administration, prompted the early work, carried out with the oxyhemograph. It seemed that a continuous record of blood oxygen should offer information, otherwise impossible to obtain under the short-acting barbiturates. As the study progressed, the combination of pentothal sodium-nitrous oxide-oxygen was included because of

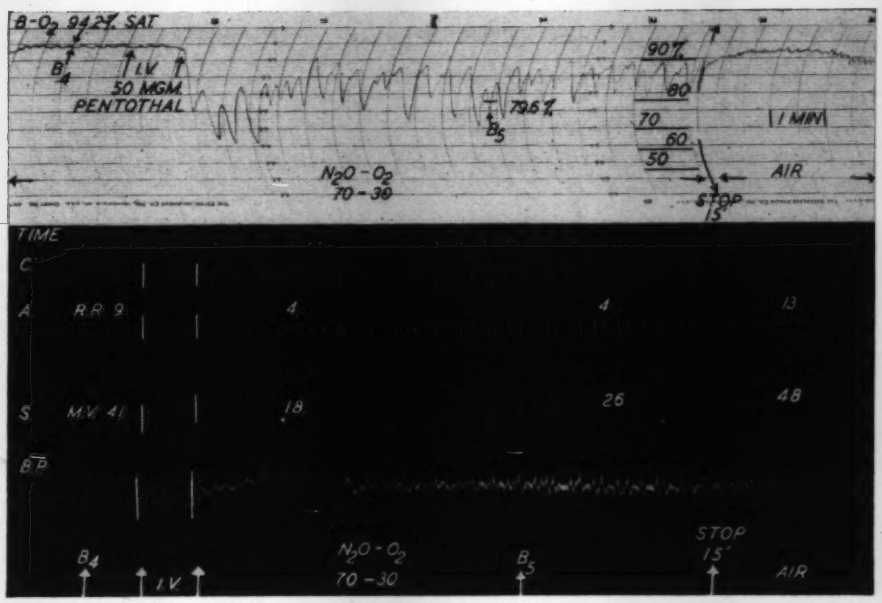

Fig. 3.—Simultaneous tracings of the blood oxygen saturation in per cent ($B\text{-}O_2$), time in fifths of a minute, costal (C.) and abdominal (A.) respiration, spirometer (S.) record of pulmonary ventilation, and blood pressure (B.P.) on a dog, subjected to pentothal sodium-nitrous oxide-oxygen anesthesia are shown. B_4 and B_5 represent analyses of arterial blood. Respiratory rate (R.R.) and pulmonary ventilation per minute in deciliters (M.V.) are stated at intervals. An intravenous (I.V.) injection of pentothal sodium during the administration of a 70-30 nitrous oxide-oxygen mixture causes a depression in the respiration which is reflected in the blood oxygen level as the curve drops sharply toward 64 per cent saturation. As the expiratory phase of each respiratory cycle is completed, one observes an immediate upward swing of the pointer to a peak, followed by a fall until the end of the next respiratory cycle. It is possible to aline each wave in the tracing with a breath, although two respirations, in close succession, lead to a double-peaked wave. After a fifteen minute period of breathing air, the more rapid respiration of lighter anesthesia results in a return of the blood oxygen saturation to normal with the respiratory effects on the tracing smoothing out.

its extensive use in surgical anesthesia. Arterial oxygen levels were followed under pentothal sodium anesthesia, supplemented by nitrous oxide-oxygen mixtures, in proportions ranging from 25 per cent nitrous oxide and 75 per cent oxygen to 90 per cent nitrous oxide and 10 per cent oxygen. Both experimental and clinical subjects were used in these studies.

The first work was performed on the experimental animal under anesthesia maintained by the short-acting barbiturates. Most of the animals received no premedication but were given a minimal surgical dose of the barbiturate for the operative procedure. A few animals received morphine sulfate, gr. ¼ to ½, as premedication and local anesthesia for the operative procedure.

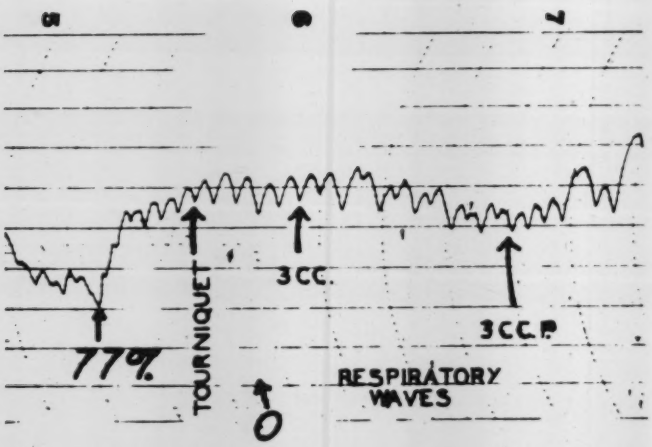

Fig. 4.—A five minute excerpt from the oxyhemograph record during the first ten minutes of pentothal sodium anesthesia on a clinical subject, breathing room air, is shown. The waves (6-8 per minute) are created by changes in the oxygenation of the blood coincident with the respiratory cycle. The symbols represent: (O) open wound, (P) pentothal sodium, 5-6 represents a two minute period.

Continuous blood oxygen saturation curves, with simultaneous records of blood pressure, tidal air, and costal and abdominal respiration, were obtained on dogs under light, moderate, and deep anesthesia. Coincident oxyhemograph and kymograph recordings, illustrative of the data obtained in the experimental animal, are shown in figure 3.

Clinical data were acquired on 20 orthopedic cases, in which the patients were subjected to pentothal sodium, pentothal sodium-oxygen, or pentothal sodium-nitrous oxide-oxygen anesthesia, of a duration ranging from 17 to 218 minutes. Preoperative medication consisted of morphine sulfate, gr. 1/4 to 1/6, and atropine sulfate, gr. 1/150. The pentothal sodium was administered by the intermittent technic of Lundy, and the dose varied according to the individual's sensitivity to the drug. The total dose ranged from 0.5 to 1.75 Gm. The inhalation anesthesia was administered by face mask in the usual manner. The blood oxygen curves on the clinical subjects included a normal (room air) record, the effect of the induction by pentothal sodium given intravenously, and any fluctuations occurring throughout the duration of the anesthesia. Although a 50-50 per cent nitrous oxide-oxygen mixture was preferred, the effects of altering the ratio of nitrous oxide to oxygen on the blood oxygen curve were obtained (fig. 5). Two blood samples were obtained by arterial puncture during the anesthesia for calibration of the curve. Gas samples were drawn from the rebreathing bag for analysis to verify the nitrous oxide-oxygen mixture administered.

The experimental and clinical results were in excellent agreement. The variation in the individual's sensitivity to pentothal sodium was demonstrated in many instances. Severe respiratory depression during induction

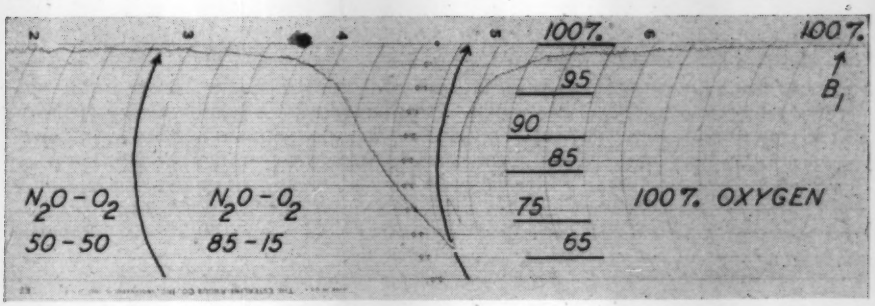

Fig. 5.—An eleven minute excerpt from the blood oxygen tracing during the first one-half hour of pentothal sodium-nitrous oxide-oxygen anesthesia on a clinical subject, undergoing an orthopedic operation. Patient received premedication of morphine, gr. 1/6, and atropine, gr. 1/150, followed by 0.85 Gm. pentothal sodium. The tracing shows the efficiency of 50-50 nitrous oxide-oxygen and 100 per cent oxygen in maintaining an oxygen saturation of 98 to 100 per cent. A four minute administration of an 85-15 nitrous oxide-oxygen mixture caused a steady decrease in the blood oxygen saturation to 68 per cent. B_1 represents an arterial puncture and its analysis.

led to a fall in the blood oxygen saturation from the normal value of 95 per cent to danger levels of 75 per cent or lower. The beneficial effect of oxygen therapy was illustrated, not only experimentally but also in the operating room (fig. 5).

Organe and Broad[13] (1938) first used the combination of pentothal sodium-nitrous oxide-oxygen in order to obtain relaxation that is impossible with nitrous oxide alone and to avoid the prolonged depression caused by larger doses of the barbiturate. They used an 85-15 nitrous oxide-oxygen mixture, thus reducing the pentothal requirement to slightly more than half the usual dosage. Our results show that an 85-15 nitrous oxide-oxygen mixture as a supplement to pentothal sodium anesthesia is inadequate. In ten instances, a reduction of the oxygen supply below 20 per cent caused an immediate decrease in arterial oxygenation as indicated by the oxyhemograph (fig. 5). Severe hypoxemia usually developed within two to four minutes after the oxygen supply was reduced. An evaluation of the pentothal sodium-nitrous oxide-oxygen combination indicates that the oxygen content of the nitrous oxide-oxygen mixture should be 40 per cent or higher, if the arterial oxygen is to be maintained at safe levels during anesthesia periods of more than one-half hour duration.

The report of Barton and his associates[14] on the effect of pentothal sodium alone as well as in combination with oxygen or nitrous oxide on arterial blood gases seems to be in accord with our findings. However, the continuous arterial oxygen saturation curves have the advantage over the separate sample method

13. Organe, G., and Broad, R. J. B.: Pentothal with nitrous oxide and oxygen. Lancet 2: 1170, 1938.

14. Barton G. D.; Wicks, W. R., and Livingstone, H. M: The effect of pentothal alone and in combination with oxygen or nitrous oxide-oxygen on arterial blood gases. Anesthesiology 7: 505, 1946.

used by these workers, for a complete picture of minute-to-minute fluctuations is available.

One of the common accidents which may occur in the postanesthesia period is depicted graphically in figure 6. This record was obtained quite unexpectedly at the close of a fifty minute pentothal sodium-nitrous oxide-oxygen anesthesia period. Failure to support the chin after the removal of the mask, during and immediately after the transfer from the operating table to the stretcher, probably caused the base of the tongue to fall back, thus blocking the pharynx. Elevation of the chin restored an adequate airway immediately. This record should impress all concerned with the need to be on the alert during the immediate postoperative period. It is evidence in favor of a postoperative recovery room.

Valuable data have been accumulated for cyclopropane, ethylene, ether, and spinal anesthesia. The use of the instrument during several Blalock operations has afforded striking and useful records of the fluctuations in arterial blood oxygen which occur as the operative procedure is carried out.

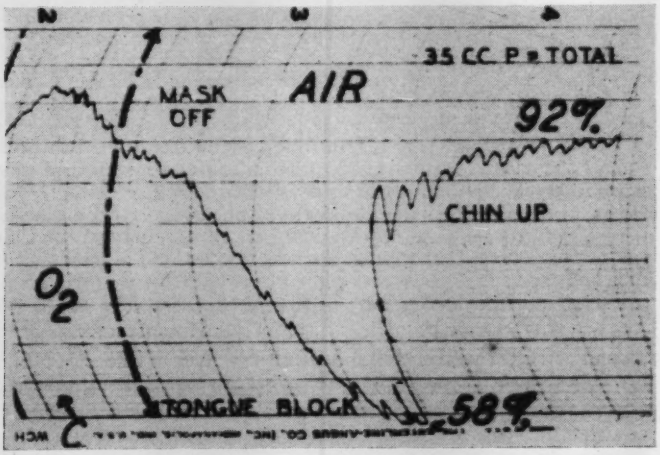

Fig. 6.—An asphyxial period (two and one-quarter minutes), which occurred at the close of a patellectomy operation performed under pentothal sodium-nitrous oxide-oxygen anesthesia, is shown. Oxygen had been administered for one minute prior to the removal of the mask. A lessening of muscle tone caused a relaxation of the tongue so that its base fell back to block the pharynx. By simply lifting the patient's chin, the low blood oxygen value of 58 per cent is restored to the normal level of 92 per cent. Symbols represent: (C) close wound, (P) pentothal sodium, 2-3 indicates a two minute period.

Summary

The usefulness of the oxyhemograph in the study of various conditions associated with anoxemia has been demonstrated. It should prove to be an effective tool for the evaluation and selection of anesthetic agents. From a practical viewpoint, however, it is obvious that graphic continuous information concerning the

(*Continued on page* 218)

ANESTHESIA FOR UPPER ABDOMINAL SURGERY

Eugene M. Bricker, M.D.*
St. Louis

It will be well for a surgeon, speaking on the present subject, to speak as a surgeon and not to try to speak as an anesthetist. Few surgeons know as much about the science of anesthesia as they would like to know. It is fortunate that the old days are gone and that now the breadth of this science forces its acceptance as one of the medical specialties. Patients have benefited immeasurably through better anesthesia. At the same time, the life expectancy of the average surgeon has been notably increased through his no longer having to cope with the harrowing experiences of primitive methods of anesthesia. Many advances in surgery are directly attributable to the fact that procedures, previously impossible, can now be accomplished with the aid of anesthetic methods that help maintain the normal physiologic mechanism over long periods. No longer is surgery a race between the surgeon and the appearance of ill effects of the anesthetic or the struggling and awakening of the patient. Practically never do we now hear of the phenomenal speed of a surgeon. The safety of anesthesia, among other factors, has turned his attention to surgical details that have decreased mortality and lowered the incidence of postoperative complications. In addition, refinements in technic and choice of anesthetic agents make it possible to consider the comfort of the patient and to conduct him through the adventure without the residual nightmare memory of strong-arm tactics that in the past were all too common.

Read before the Fourteenth Annual Meeting of the American Association of Nurse Anesthetists, St. Louis, Sept. 25, 1947.
*Associate Professor of Clinical Surgery, Washington University School of Medicine.

PREOPERATIVE CARE

In considering the subject of anesthesia for upper abdominal surgery, then, let us approach the problem from the standpoint of the surgeon. His patient must be prepared for the operative procedure, which involves preparation for the anesthesia as well. Actually, the operation and the anesthesia are inseparable parts of the same maneuver, and usually the steps in preparation of the patient are aimed at both. Thus, a distended stomach is lavaged and emptied to facilitate the work of the surgeon and to decrease the danger of aspiration of stomach secretions during anesthesia. Shock is corrected by resuscitation, since both the anesthesia and the surgical proced-

ure may increase its severity. Anemia, water and electrolyte balance, and, when possible, the general state of nutrition must be corrected. The surgeon, then, approaches the problem of anesthesia for his patient during the entire preoperative course. His aim is to get the patient on the operating table in the best possible condition for the operative procedure under a properly chosen type of anesthesia.

The anesthetist, on the other hand, has a slightly different approach in that she usually does not see the patient until the day before operation. However, she brings to the patient and surgeon the specialized knowledge and technical skill that are so necessary for the satisfactory and safe completion of the operative procedure. The skills of these two, the surgeon and anesthetist, should complement each other and should result in complete understanding and control of all the variable factors, difficulties, and hazards that might be encountered during the conduct of the operation.

Problems of Anatomy

What is peculiar to upper abdominal surgery that should make us consider anesthesia for surgery in this region as a special subject? There is great divergence of opinion as to the best type of anesthetic for any type of abdominal surgery. However, it is generally agreed that the nearer the incision is to the diaphragm, the greater are the difficulties encountered. This is easily understandable if one considers the anatomy and physiology of the region. This part of the abdomen participates most actively in respiration, movement being imparted to the abdominal wall by the moving costal margins. The abdominal viscera in this region are also subject to continuous movement transmitted from the diaphragm. In addition to their motion, the costal margins also increase the difficulty of surgery in the upper abdomen by acting as a shield which prevents direct exposure of the upper limits of the abdomen. The muscles of the upper abdomen are thick and heavy, and the rectus muscle is especially powerful and broad in its attachment to the costal margins. Also, it is well known to surgeons that shock is much more likely to occur during upper abdominal procedures than during operations elsewhere in the abdomen. All these factors combine to make upper abdominal surgery one of the most trying types for surgical accomplishment. Surgical procedures in this area serve as prime examples of the type in which proper anesthesia plays an important role.

In addition to the anatomic and physiologic peculiarities of the upper abdomen, certain characteristics of the pathologic conditions of this region have an indirect bearing on the problems of anesthesia. For instance, one of the most common upper abdominal operations is cholecystectomy. It happens that disease of the gallbladder is frequently associated with a habi-

tus that makes surgical exposure of this organ difficult. The patient is often thick, muscular, and fat, with a wide costal angle. Women patients are preponderant, and they are so often obese that the jingle of "female, fat, and forty" has become attached to the disease in medical school teaching.

Of the organs in the upper abdomen, the stomach is perhaps second in frequency of attack from disease. A major portion of the stomach is situated beneath the rib margins. Its exposure requires muscular relaxation and quiet respirations. Many operations on the stomach are prolonged and require exposure from the region of the first portion of the duodenum to high beneath the diaphragm. Operations for resection of carcinoma of the pancreas fall into the same category, i.e., they require long tedious dissections and wide exposure of almost the entire upper abdomen. Resection of the spleen, similarly, requires good exposure of the depth of the abdomen beneath the dome of the diaphragm. In addition, splenectomy is usually done for conditions which increase the operative risk and which make it necessary that the operation be speeded by good anesthesia and muscular relaxation. Thus, the nature of the diseases and the technical procedures aimed at their eradication, together with the anatomic and physiologic characteristics of the upper abdomen, is responsible for the importance of anesthesia for surgery in this area.

SURGICAL APPROACH

Before considering the methods by which anesthesia helps solve the problems presented in the foregoing paragraphs, it is pertinent to discuss briefly the methods by which surgery can contribute to the solution. Preparation of the patient has already been mentioned. The patient, therefore, is received in the operating room in as good a physiologic state as is possible as a result of the surgeon's efforts. Next, the surgeon can take an important step toward solving the problems presented in surgery of the upper abdomen by planning his approach to meet the needs of the moment. Just as muscular relaxation from anesthesia will give access to this region, a properly placed incision will expedite the procedure. Thus, it is logical that an incision for cholecystectomy should be on the right side of the abdomen in order to supplement the muscular relaxation of anesthesia by a direct approach to the lesion. Likewise, other lesions may justify special variations of approach to fit specific needs. The day has passed when surgeons used one avenue of approach to the upper abdomen, i.e., the vertical incision. In retrospect it is surprising how little attention was paid to the anatomy of the abdominal wall and how little imagination was exercised in its transection. The modern abdominal surgeon is adept at traversing the muscles and structures of the abdominal wall in such a manner that maximal advantage is taken of anat-

omic exposure. Thus transverse and subcostal incisions as well as midline, paramedian, and rectus-splitting approaches should be in every surgeon's armamentarium. Although a surgeon may have a preference for one approach, there will always be cases in which another type of approach may be indicated. Splenectomy has always been a relatively difficult operation because of the position of the spleen deep under the costal margin. Removal of the spleen can be greatly facilitated by a long transverse incision or by a combined thoracoabdominal approach. Many surgeons believe that cholecystectomy is facilitated and the postoperative course smoothed by use of a subcostal incision. This subject of surgical approach has a direct bearing on the subject of anesthesia, in that the more direct and efficient the approach and exposure, the less will be demanded of the anesthetic. The duration and depth of anesthesia and the length of operating time are factors influenced by the type of incision used. These factors are also directly related to the postoperative comfort and well-being of the patient and to the possibility of postoperative complications.

Special mention should be made of the thoracic or combined thoracoabdominal approach to the upper abdomen. This left-sided approach aimed at lesions involving the spleen, esophagus, and upper part of the stomach is becoming increasingly popular. It involves opening the chest with the abdomen and requires provision for intratracheal positive pressure anesthesia as is necessary for any thoracic procedure causing an open pneumothorax.

CHOICE OF ANESTHETIC

Therefore, when the surgeon makes the incision, it is desirable that the anesthetic be so chosen and administered that the all important factor of surgical exposure can be accomplished as easily as possible. For this to be done, the anesthetic must provide muscular relaxation and quiet respiratory movements. In addition, it should be one that minimizes operative shock and affords a low incidence of postoperative pulmonary complications. These ends can be accomplished by several methods, and there are indications and contraindications for each. The following methods are those most commonly used for upper abdominal surgery:

1. Intratracheal gas-oxygen-ether anesthesia, using cyclopropane or nitrous oxide. This method has become widely popular with surgeons who do a lot of upper abdominal surgery. It has the great advantage of providing quiet respirations, a free airway, and a high percentage of oxygen in the inspired mixtures. If the surgeon has added to this advantage by using a properly placed and adequate incision, he is able to complete his work with a minimum of operative trauma. All these factors contribute to the smoothness of the operation and the postoperative course. If respirations have been poorly controlled and it has been

necessary to struggle with the bowels to keep them out of the operative field, it is certain that ileus and abdominal distention will be increased in the postoperative period. If relaxation has been poor and if, to get satisfactory exposure, it has been necessary to exert great force in retracting the edges of the wound, the muscular soreness and pain in the wound subsequently may predispose to the development of pulmonary complications. Indeed, postoperative pulmonary complications following upper abdominal operations could practically be abolished if pain from the wound could be eliminated. Inhibition of cough and shallow, guarded respirations as a result of a painful wound are more frequently the cause of atelectasis and pneumonitis than is aspiration of foreign material or obstruction of a bronchus at the time of operation. However, the last two complications are all too common and add to the reasons for using intratracheal anesthesia. No other method of anesthesia gives as much assurance of a protected airway or allows such prompt and efficient handling of mucus and secretions in the bronchial tree.

2. Curare, though not an anesthetic agent, is mentioned next because of its wide acceptance as an adjunct to anesthetic agents. Perhaps in no other field of surgery is it proving of more use than in surgery of the upper abdomen. Acting on the neuromuscular junction, it promotes muscular relaxation to a satisfactory degree without the need for deep anesthesia. It is most important, if curare is to be used, that the anesthetist be prepared to take over respiration for the patient. This situation prevails ideally when curare is used in conjunction with intratracheal gas-oxygen-ether anesthesia.

3. General inhalation anesthesia using gas-oxygen-ether mixtures with a closed mask has perhaps been the most common type for upper abdominal surgery and follows the intratracheal method in popularity with most surgeons. It has no true advantage over intratracheal anesthesia and lacks some of the most important advantages of the latter, e.g., control of the airway. However, there are still many cases in which the habitus and nervous make-up of the individual and the simplicity of the operation to be performed make this type of anesthesia satisfactory. Curare has increased the effectiveness of this method as it has of others. However, it should be recognized that the use of curare in the absence of complete control of the airway and respirations introduces a certain hazard that can be avoided by intubation of the trachea.

4. Spinal anesthesia is mentioned because some surgeons use it for upper abdominal procedures. However, spinal anesthesia up to a level that will permit cholecystectomy or gastrectomy is attended by considerable danger and should never be attempted by anyone other than an expert in this field. Depres-

(*Continued on page 202*)

ANESTHESIA FOR ABDOMINAL SURGERY

R. L. Sanders, M.D.*
Memphis, Tennessee

It is axiomatic that the first principle to be observed in the selection of an anesthetic for any type of operation is the safety of the patient. In abdominal surgery, another principle is also involved: the anesthetic must be one that provides the most favorable operating conditions. The agent that best fulfils the requirements of maximal relaxation and exposure not only facilitates the technical performance, but, in so doing, minimizes trauma and thus adds to the safety of the operation. Although no one type of anesthetic at present meets all these requirements, the variety of drugs and methods of administration at our command permits combinations of those most suitable to the need of the individual patient and most satisfactory from the standpoint of the surgeon.

With few exceptions, we employ three different methods of anesthesia for operations upon the abdomen: inhalation, intravenous, and spinal. I shall review the special features of each of these types separately and in combination, as we have observed them.

Read before the Tenth Annual Meeting of the Mid-South Assembly of Nurse Anesthetists, Memphis, Tennessee, Feb. 12, 1948.

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Inhalation Anesthesia

From the standpoint of the patient's safety, the chief consideration is adequate oxygenation. Every inhalation anesthetic alters the normal exchange of oxygen and carbon dioxide to some extent and thus commensurately influences body functions. Nitrous oxide is undesirable for abdominal surgery in that it carries a serious danger from anoxemia; further, it does not provide adequate relaxation which is so essential to operations deep in the abdomen. Ether alone, as is well known, has a definite toxic action, which is particularly pronounced in long abdominal operations. Also, the postoperative nausea and vomiting commonly associated with ether anesthesia are especially disadvantageous in upper abdominal surgery. Of all the gases, cyclopropane is most suitable for this type of surgery because of the high concentration of oxygen and freedom from toxic effects upon the liver and blood chemistry. The fact that it may be mixed with a large quantity of oxygen is a distinct advantage in the presence of respiratory tract obstruction, anemia, debility or shock, or in any situation in which an abundance of oxygen is necessary.

The major difficulty with cyclopropane is that it fails to provide complete relaxation of the tissues and thus does not alone meet the requirements for a satisfactory anesthetic. In current practice this difficulty is largely overcome by use of a mixture of ether and cyclopropane. We have used this combination of drugs for all types of abdominal operations with, on the whole, excellent effect.

Cyclopropane may often be used to advantage in combination with other types of anesthesia. During the course of spinal anesthesia, cyclopropane may be given as a supplementary agent if the drug used for the spinal anesthesia begins to lose its effect before the conclusion of the operation. For elderly patients cyclopropane is preferable to intravenous anesthesia as a supplement, since they wake more promptly and thus are less subject to pulmonary complications.

INTRAVENOUS ANESTHESIA

Since the development of pentothal sodium, intravenous anesthesia has had a wide variety of uses in abdominal surgery. We employ intravenous anesthesia alone for such short operations as dilatation and curettage, removal of tissue for biopsy, incision and drainage of abscesses, excision of tumors of the breast, simple amputation of the breast, and often for appendectomy. The method is not suitable for prolonged abdominal operations, however, in that muscular relaxation is inadequate. Moreover, the required dosage is so large that respiration is depressed, sometimes to a dangerous degree. In any type of case pentothal sodium should be given in a weak solution and in small quantities; this point cannot be too strongly emphasized. If the drug is given in excessive doses or too rapidly, the patient may stop breathing within the first few minutes after induction and may be resuscitated with difficulty. We have had this experience several times. Occasionally, in fact, resuscitation may be impossible. In our city several patients have died on the table within the first five minutes after the beginning of induction. One of my colleagues lost a patient in this manner, despite the fact that artificial respiration was continued for eight hours. The drug does not affect heart function; rather, its effect is entirely upon respiratory function. In view of this danger, it is our custom to use a 2½ per cent solution of pentothal sodium and to give only a few drops at a time, keeping constantly on the alert for signs of respiratory embarrassment.

Because of its adverse effect upon respiration, pentothal sodium anesthesia is obviously unsuitable for patients with respiratory tract infection. Nor should it be given to those with heart or liver disease, diabetes, severe anemia, or severe hypotension, or to those in shock. It is also considered dangerous for patients who previously have received sulfonamide therapy, as the combination of the two drugs appears to interfere with oxygenation of the blood.

In major abdominal surgery pentothal sodium anesthesia has gained wide favor in combination with, or as a supplement to, other methods. As an induction agent prior to inhalation anesthesia, we frequently give pentothal sodium to patients who are apprehensive and who fear the application of a mask. As a supplement to inhalation anesthesia, it may also be employed for the control of cough, sneezing, tremor, hiccough, or convulsions. We also give pentothal sodium occasionally during spinal anesthesia to prevent a psychic reaction incident to the operation and to control nausea, vomiting, and pain from traction on the viscera. If the operation is prolonged and the effect of the spinal anesthetic begins to wear off, the patient may be easily carried through the remainder of the procedure with a small amount of pentothal sodium combined with curare. This agent is preferable to cyclopropane for such purposes for all except elderly or debilitated patients.

Among its other advantages, intravenous anesthesia is rapidly and easily induced, and the dosage is readily controlled; further, the postoperative course is comfortable, being free from vomiting and distention, and postoperative complications are rare.

SPINAL ANESTHESIA

During the past few years, we have been using spinal anesthesia in an increasing number of abdominal operations. The drug paralyzes the sympathetic nerves and increases the activity of the parasympathetics, thus contracting the intestines and causing them to empty. This permits ample exposure and allows the surgeon freedom of movement within the abdominal cavity. These factors, combined with the excellent relaxation and quiet respiration of spinal anesthesia, make ideal operating conditions and, in so doing, reduce the trauma of surgery.

We have found spinal anesthesia suitable for every type of abdominal operation and for almost every type of patient, whether young and robust or elderly and debilitated. In robust patients, the difficulty of obtaining adequate relaxation has often been a problem with the use of inhalation anesthesia. Therefore, unless there is a definite contraindication to its use, we now employ a spinal agent routinely in abdominal operations upon this group of patients. The virtue of spinal anesthesia for the elderly and debilitated lies in the fact that its effect upon liver and kidney function is negligible, metabolic processes are essentially undisturbed, and, with proper precautions, cardiac complications seldom arise. Some surgeons question the advisability of using spinal anesthesia for patients with cardiovascular disease. In our experience cardiovascular disease does not present a contraindication, provided the patient is first properly prepared by the administration of fluids and blood transfusions. Other advantages of this method are the short period of induction and the freedom from abdominal distention, nausea and vomiting

during the postoperative course.

Because of its direct action upon the central nervous system, a spinal anesthetic should not be given in the presence of any type of nervous affliction. The danger may be slight, but it should not be overlooked.

Spinal anesthesia is at times accompanied by a psychic reaction from fear of the drug itself or from fear of the surgical procedure. For these reasons, we refrain from telling patients they are to have a spinal anesthetic; instead, we use the term "nerve block." Any psychic disturbance, however, may be prevented by preoperative sedation or, if necessary, by the production of light general anesthesia prior to, or during the course of, operation.

Spinal anesthesia is not infrequently associated with nausea and vomiting from traction on the viscera or low blood pressure. This condition may be relieved by the administration of oxygen or a vasopressor drug or, if these measures fail, by pentothal sodium anesthesia.

Atelectasis has developed within a short time after spinal anesthesia in a fairly large number of our patients. We have noticed this particularly after operations beneath the diaphragm, such as vagotomy, resection of the stomach, and repair of diaphragmatic hernia. As soon as the symptoms appear in such cases, the patient is returned to the operating room for aspiration of the bronchi.

Another possible sequela, and one which we have often encountered after section of the vagus nerves for duodenal ulcer, is hiccough. Apparently this is related to manipulation of the esophagus in the effort to free the nerves and bring them down through the diaphragm. The condition usually responds rapidly to small doses of pentothal sodium.

A number of authors have called attention to the occurrence of distressing headache after spinal anesthesia. Our operations under spinal anesthesia number approximately 2,500, yet not more than a dozen of these patients have complained of severe headache postoperatively.

One cannot overemphasize the necessity for the most careful supervision of the patient during the course of spinal anesthesia. We believe that, following induction of anesthesia by the surgeon, the patient is entirely safe in the hands of a competent nurse anesthetist, one who is capable of detecting the first signs of respiratory and circulatory collapse and of instituting proper measures for their correction.

If, for any reason, spinal anesthesia is undesirable, or if the patient prefers a general anesthetic and abdominal relaxation is inadequate, curare is an excellent agent for producing the desired relaxation. Since only a light dose of a general anesthetic is necessary in combination with this drug, some surgeons advocate its use almost routinely. It may be combined with cyclopropane or pentothal sodium as a supplement to spinal

anesthesia if the latter begins to subside before completion of the operation. For debilitated or elderly patients or for those in shock, the dosage should be small. The chief danger associated with the use of curare lies in the possibility of respiratory depression or apnea. As a precaution against this contingency, intratracheal intubation is advisable.

Complications

The administration of any type of anesthetic may be attended by difficulties and complications. Obviously, the best solution to these problems lies in prevention. In large measure this is within the province of the surgeon. It is to be presumed, however, that, before any operation, the anesthetist will become familiar with the circumstances of the case, i.e., with the patient's general physical and mental condition, age, and constitutional build, as well as with the type of operation and its probable duration, in order that an appropriate anesthetic may be chosen and that any unfavorable developments concerned with the anesthetic may be precluded insofar as possible. Moreover, the effects of the anesthetic do not always end with the period of anesthesia but may be carried over into the postoperative period, perhaps with dangerous consequences. Although the patient is no longer in the hands of the anesthetist, the prevention of such complications as postoperative atelectasis and pneumonia, pulmonary embolism, and thrombophlebitis is to some extent the anesthetist's responsibility.

The chief danger in the administration of any type of anesthetic is the development of anoxia; this leads not only to respiratory and pulmonary complications but, if not successfully combated, to metabolic, cardiovascular, and even cerebral complications. Therefore, the maintenance of an open airway is the first requisite in the prevention of these sequelae. Assuming that every measure has been taken preoperatively to clear the air passages, it remains for the anesthetist to see that they remain clear during the course of anesthesia and until the patient recovers from the effects of the drug.

Anoxia may be induced by too heavy preoperative sedation, by too deep anesthesia with an inhalation anesthetic, or by laryngospasm. In turn laryngospasm may be due to irritation from an inhalation anesthetic when the anesthesia is too light; in this event the spasm may be relieved if the anesthesia is pushed a little deeper. Again, laryngospasm may be induced by reflex stimulation of the trachea or laryngeal nerves, by traction on the viscera, by vomiting, or by the accumulation of mucus and secretions in the air passages. Spinal anesthesia which extends too high may give rise to anoxia through respiratory depression; in some cases the diaphragm may be completely paralyzed. Visceral pressure upon the diaphragm incident to the Trendelenburg position, particularly in obese patients, may have a similar effect. Anemia, infection, and shock are among the conditions that

may contribute to anoxia of anesthesia. In certain disease conditions, such as coronary insufficiency, even slight anoxia may be of serious consequence.

Restriction of preanesthetic medication to the minimum requirement will do much to prevent anoxia. Atropine is useful both as a prophylactic and as a therapeutic measure, in that it serves to prevent accumulation of secretions in the air passages and to inhibit spasm of the intestines.

As a rule, anoxia during anesthesia may be effectively overcome by the administration of oxygen in high concentration, combined with a small quantity of carbon dioxide. Anoxia during cyclopropane anesthesia may often be combated by the addition of helium to the anesthetic mixture. In the presence of contracted bronchioles the heavy gas cannot penetrate into the lungs; helium serves to lighten cyclopropane and allows it to sneak through the narrow passageways. If necessary in such cases the intratracheal tube may be inserted to facilitate absorption.

If anoxia is due to the surgical maneuver, it may be relieved following discontinuance of the traction. Mucus or foreign material obstructing the air passages should be removed by forcing the patient to cough or by aspiration.

Circulatory depression incident to anoxia from excessive loss of blood, surgical trauma, too profound anesthesia, or any other cause may occur during the course of an abdominal operation. The treatment consists of the administration of oxygen and stimulants, fluids intravenously, and blood transfusion. As a rule, the intramuscular injection of a vasopressor drug, such as ephedrine or epinephrine, will bring about a rise in blood pressure within a short time, though in extreme cases the drug is best given intravenously in 50 mg. doses.

POSTOPERATIVE CARE

The primary requisite in the postanesthesia care of the patient who has undergone abdominal surgery is the prevention of pulmonary complications. To this end, all obstructing material should be removed from the air passages at the conclusion of the administration of the anesthetic. As a rule, the obstruction may be removed by re-establishment of the cough reflex on turning the patient from side to side. However, if the cough reflex is too deeply depressed to respond to this maneuver, or if the patient refrains from coughing because of pain, the reflex should be forced under light anesthesia. Should this fail, the passages should be cleared by aspiration through a catheter. This should be done before the patient is taken from the table. If obstruction, as evidenced by rapid pulse, impaired respiration, cyanosis, and fever, recurs after the patient leaves the operating room, he should be returned at once to the operating room and suction bronchoscopy done. The effect of this procedure is dram-

atic; within a few minutes the symptoms subside, and the patient recovers completely from the acute illness. I believe we have saved a number of patients from atelectasis or pneumonia by this method. To maintain adequate aeration of the lungs, oxygen may be administered by intranasal catheter or by tent throughout the first twenty-four hours. We have found this especially valuable after operations upon the common duct and stomach, as well as after those about the diaphragm.

SUMMARY

At the beginning of this discussion I mentioned the fact that the anesthetic agent for any operation should be chosen with regard to the preference of the surgeon. Different surgeons work best with different types of anesthesia. Many prefer general anesthesia, others regional, others spinal. Some surgeons operate swiftly, others slowly. The anesthetic, therefore, should be one suited to the surgeon's temperament and technic, since obviously these factors materially influence the safety of the operation. For the same reason the anesthetic should be one with which the anesthetist is familiar and which she can administer with skill and with the least danger of complications. The success of the entire procedure, therefore, depends upon the closest co-operation between the surgeon and the anesthetist in these matters. The combination of an anesthetic which insures the most favorable operating conditions for the surgeon and skilful administration on the part of the anesthetist provides a strong bridge over which the patient may be carried to safety.

UPPER ABDOMINAL SURGERY

(*Continued from page* 195)

sion of the blood pressure may be marked, and severe respiratory embarrassment may ensue if the anesthetic drug reaches too high a level in the subarachnoid space. In ordinary hands and as a general rule, spinal anesthesia should not be used for surgery of the upper abdomen.

5. Local analgesia by field block of the abdominal wall or by a combination of field block and bilateral intercostal block has often proved useful for debilitated patients, for patients in shock, or for patients to whom a general inhalation anesthetic cannot be given. The upper abdomen is well suited to this procedure, since it is quite simple to block the segmental spinal nerves which course just beneath the rib margins. Complete anesthesia and fair relaxation of the abdominal wall are possible, especially if the patient has had adequate basal sedation or if it is possible to administer pentothal sodium at the time of the procedure. Every surgeon should be able to administer local infiltration and regional block anesthesia for abdominal surgery, since there will always be cases in which the methods are primarily indicated.

ANESTHESIA FOR PLASTIC SURGERY

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Anesthesia in plastic surgery is as important as in any other branch of surgery, and it presents some of its own complications and challenges. The main complication in surgery about the face and neck is that practically all the anesthesia has to come through the operative field. Another challenge in plastic surgery is that the surgeon cannot do decent surgery without decent anesthesia. For instance, if local anesthesia is used, the surgeon cannot operate smoothly unless the patient is not having pain. In general anesthesia, if the airway cannot be maintained, or if the anesthesia is not even and steady, not only is there danger to the patient, but the surgery cannot be done efficiently. Thus, it may be said that in plastic surgery the anesthetist is really part of the operating team.

We have been struggling for many years to perfect anesthesia on our service. It is not perfect now, but we have come a long way in the last few years. The record of practically no fatalities in the face of severe and complicated procedures is most encouraging and hopeful. The record of Maj. Richard D. Sanders and his co-workers, Dr. Wallace Reed and Miss Matilda Katterhensy, on our plastic surgery service at the Valley Forge Hospital is one of great accomplishment: 40,000 operations were done without a fatality.

There is another point about co-operation and teamwork in anesthesia for this type of surgery. For other kinds of surgery, through lack of co-operation of the house officer or the nurse on the ward, a patient might undergo an operation with a stomach full of food, but this is not safe in surgery about the mouth and face. The teamwork has to start in the ward the day before operation.

These statements might seem rather trite, but the principles are so true and so basic and so important that unless they are realized and carried out, no matter how smooth other technics are, the results will not be so good as they might be.

The Army record in plastic surgery that has just been cited does not mean that just one person did a good job; it means that there was co-operation, and that the patient was protected all down the line by the individual attention and interest of many in-

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dividual workers. It is true that the soldiers were young men and could take almost anything, but they underwent the most severe types of operations and the most difficult types of anesthesia. The men were likely to be upset mentally and to be apprehensive, and a problem of great importance was that many patients had to undergo upwards of twenty operations apiece.

What can be done when a patient needs so many operations? The only thing to do is what the patient wants. The best principle is the simple one of the golden rule: As far as possible, we can do what we would like to have done if we were the patient.

These things may seem obvious, too, but from many years' experience in trying to run one of these services, I assure you that these basic philosophic approaches are as important as technics. What did happen in this large series of cases? What happened to the great credit of the anesthetist? We found that most of the soldiers who had to have repeated operations wanted general anesthesia. They usually did not want to face local anesthesia for repeated operations.

Pentothal sodium was a great boon to these patients. However, with regard to intravenous or rectal anesthesia, it has become a popular notion that any length or type of operation can be done under these types of anesthesia alone. The patients do not know, and apparently it is sometimes forgotten, that an airway has to be kept open throughout the procedure, and even to start with there may be trouble with the airway in intravenous anesthesia. However, in plastic surgery and especially for those patients undergoing repeated operations, intravenous anesthesia is of great benefit, especially during induction and also while switching to ether or while relying on oxygen and nitrous oxide along with the intravenous anesthesia. It is a good thing for the patients, but it does not replace care in the protection of the patient or in the anesthetic technic.

We think the record made on our service is excellent, but the effect on the whole service of a serious complication or a fatality always leaves one introspective about one's own responsibility. We think the basic approach of what is best for this single patient is the proper way to go about the work from the start. Most questions about this or that technical point can be settled by deciding what is safest for the individual patient and what one would want done if he were lying there as the patient. Anesthetists have a tremendously important role to play in the teamwork, and if everyone can have the same approach to the problems of the patient, the work goes along best.

Often the anesthesia has to come right through the operative field. It is blocked off as well as possible, but if an emergency were to arise, the maneuvers of the anesthetist would come right into the operative field. In difficult operations the field is sometimes the scene of a bout between the surgeon and the anesthetist. The anesthetist is going to be sure that the patient doesn't die

as a result of the anesthesia, and the surgeon is going to be sure he gets an airway for the patient and still has a place to work. Such apparent clumsiness may be a little hard to conceive. In a severe phosphorus burn, for instance, or any kind of burn in which the lip border is attached far down on the chest, the mouth is pulled open, there is no place to work, no place to give the anesthetic, the airway has to be maintained, and as the patient goes to sleep, he becomes a worse problem as the anesthesia deepens. Accordingly, we have to incise the area rapidly and get the patient's head back in order to extend his neck. Thus the anesthetist struggles to give the anesthetic, and the surgeon tries to get the mouth open and the neck up. But if the patient's life is saved, and he is relieved of his deformity, the operation has been more or less successful. These principles of teamwork cannot be emphasized too strongly. If they are not carried out, the service will not function properly.

Radical operations necessary to try to save the lives of patients who have metastatic carcinoma are a separate problem. We do them under local anesthesia only by a very distant choice, because quiet anesthesia is needed; if the patient gasps or one of the ligatures comes loose from an internal jugular vein, death from air aspiration embolism may ensue. The jugular bulb is ligated right up at the base of the skull, and this is another time when quiet, peaceful, relaxed anesthesia is necessary.

Another problem may be the possibility of explosion. Electrical apparatus used in the field of anesthesia is dangerous, and it has to be well blocked off from the airway.

In plastic surgery wound closure is part of the operation. The anesthesia has to be carried completely through into the very last part of the closure, plus the dressing. Thirty minutes may be required to put on a dressing. Anesthesia has to be maintained, although, of course, the patient can be waking in the operating room.

It is extremely important that these patients should recover where somebody is present who knows how to maintain an airway, with equipment for aspiration available at all times and means ready for re-introducing an intratracheal tube if necessary.

For some types of plastic surgery local anesthesia should or could be used. For local anesthesia about the face, nerve blocking, in many instances, is preferable to infiltration, but there are no set rules. Sometimes adrenalin is wanted in the local anesthetic, and sometimes it is not desirable. If hemorrhage is a problem, as for instance in operations about the nose, adrenalin is used because the nose has an excellent blood supply and can stand it. However, if large areas about the face or head are being undermined, as in making flaps, adrenalin is not used, because it is likely to shut off the blood supply temporarily

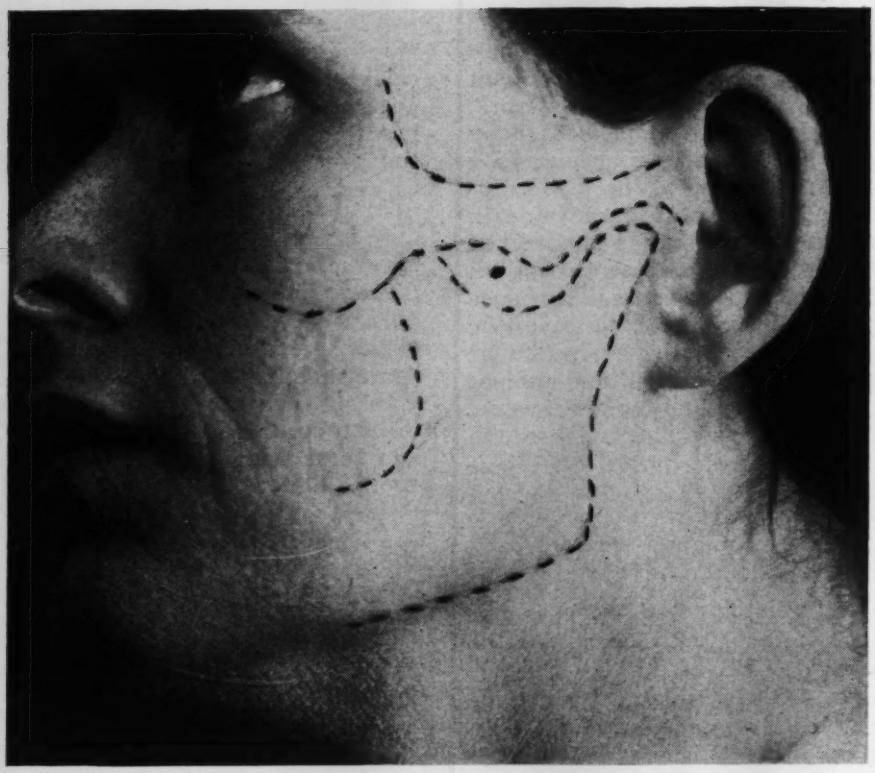

Fig. 1.—Shows the bony landmarks roughly located by palpation. The lower border of the zygoma is determined first and then the condyle by having the patient open or protrude the lower jaw. It is nearly always definitely felt as it slides forward on the articular tubercle (eminence). The point of insertion of the needle is 2 to 2.5 cm. in front of the tragus just below the lower border of the zygoma. From here it passes between the coronoid process and the condyle of the lower jaw (sigmoid fossa) and just anterior to the articular tubercle. Occasionally it may be necessary to have the mouth held open so the space between the zygoma and the mandible may be increased.*

*Illustrations and legends from: Brown, James Barrett: Deep block anesthesia. Surg., Gynec. & Obst. 53: 832-835, Dec. 1931.

and let bleeding occur later that might damage or destroy the flap.

If possible, it is preferable to block the nerves that supply the field in the simplest manner possible. External blocks are relied on, if possible, and these would be blocks of the infraorbital, mental, supraorbital, the nasal, and the zygomatic nerves. (figs. 1, 2, 3).

Deep block of branches of the fifth nerve is extremely valuable. The approach is between the condyle and the coronoid of the jaw, the first landmark being about an inch in front of the tragus of the ear, underneath the z y g o m a. The needle goes straight in for about 4 cm. to encounter the external pterygoid plate. Then the needle is directed

Fig. 2.—Shows approximate relation of needle and bony landmarks. Needle represented by a straw held in place with modelling clay. On its course inward to the pterygoid plate the needle passes through the parotid gland, the masseter, temporal, and external pterygoid muscles. It may also encounter the transverse facial, internal maxillary, middle meningeal, and masseteric arteries.

backward toward the foramen ovali and is dropped about 0.5 cm. deeper and more posteriorly; the third division comes down here, and a successful block of the entire lower jaw can be carried out. To block the upper jaw, the needle is carried forward into the sphenomaxillary fissure. The posterior wall of the antrum is encountered, and the novocain is deposited where the second division emerges from the foramen rotundum and courses across the fissure. For these blocks 2 per cent novocain with eight drops of adrenalin to the ounce is used. An absolutely direct hit is not necessary nor advisable. The area is filled with 2-8 cc., and excellent anesthesia is obtained.

The cervical nerves are blocked superficially where the external jugular crosses the sternomastoid, or a deep block is done below the tip of the mastoid. The needle goes into the transverse processes of the vertebra, and the novocain is deposited there, over a vertical line of 3-4 cm.

Fig. 3—Shows the deep course of the needle. After gently striking the pterygoid plate, by short withdrawals and re-insertions, the point of the needle is carried up to the under surface of the great wing of the sphenoid, which is about at a right angle to the pterygoid plate. From now on this under surface of the greater wing is equally important as a landmark as the pterygoid plate itself.

To inject the third division the needle is carried backward by short withdrawals and reinsertions against the pterygoid plate and being held up against the sphenoid wing. When the posterior border of the plate is reached, the needle slips off, and the patient usually experiences momentary severe pain. The fluid is injected here. It is not absolutely essential to get the pain of a direct "hit" of the nerve before injecting the fluid. If it is not thought that a direct "hit" has been gotten, an extra amount of fluid may be deposited, and a longer time should be allowed for the development of anesthesia. (Ten minutes may be necessary.) It is important to remember the rule of not going posteriorly or deep more than 0.5 to 1 cm. from the edge of the plate. Damage may be done to the internal carotid artery, the middle meningeal artery, or the eustachian tube. The pharyngeal mucosa may even be punctured and fluid gotten into the throat. (This might also happen if enough were deposited in the eustachian tube.)

To inject the second division, the needle is carried forward to the sphenomaxillary fossa and the fluid deposited here. Straws are placed to show the third division emerging from the foramen ovale and the second division coursing across the sphenomaxillary fossa.

If a patient still says it hurts, he is the one who knows. A patient may resist having the operation done and may even be untruthful about it, but as far as the surgeon and the anesthetist are concerned, if the patient says it hurts, it hurts. A strong complaint of pain usually means that there is pain, regardless of how complete the anesthesia may seem to the surgeon or anesthetist. It is useless to tell a patient it doesn't hurt when he says it does; the patient is the one who is most likely to be right.

Why can this happen? It is usually because there is an accessory nerve supply coming through some tiny little opening; a very minute nerve can cause unbearable pain around the face. Accordingly, if a patient says it hurts, it hurts. More anesthetic is needed, or it may be best to shift to general anesthesia. The best surgery cannot be done with the patient squirming all over the table and shouting that it is hurting. Perhaps all this could be summed up in the principles of the doctor-patient relationship or the anesthetist-patient relationship without which the service is not successful.

Compound facial injuries require careful discrimination as to the proper type of anesthesia. If local anesthesia can be used, it is best and safest; the jaws may even be wired together so that the mouth cannot be opened. With the patient under general anesthesia, it may not be safe to wire jaws closed. It can be done under general anesthesia, but it takes a lot of trouble, watching, and time on the part of both the anesthetist and the nurses, and means for unwiring the jaws have to be provided and understood, in case there is trouble. Under general anesthesia tracheotomy may be necessary.

It is very important to get a patient of this type to and from the operating room without his drowning in his own blood or his tongue dropping back and shutting off the airway. It is a simple thing to turn the patient on his face instead of on his back and to hold his jaw forward or his tongue out during transportation. If necessary, a special attendant should be available for this service alone.

An anesthetist should be available for all operations, and for major procedures under local anesthesia; it is preferable that an anesthetist be present to watch the patient under local anesthesia almost as closely as though general anesthesia were being given.

The patient-anesthetist relationship is of great importance in the psychological preparation of the patient for the operation. We need to relieve his anxiety and agree to help him out, and it will be found that patients under local anesthesia may need that security more than if they were given general anesthesia.

ANESTHESIA FOR PERSONS WITH HYPERTENSION

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The choice of anesthetic for persons with hypertension is determined by the nature of the dysfunction responsible for, or associated with, the hypertension, by the degree of coexistent damage to kidneys, heart, and brain, and by the effect of the anesthetic on blood pressure.

There are two major types of hypertension, the systolic and the diastolic. The systolic blood pressure may be elevated with a normal or decreased level of diastolic pressure in aortic insufficiency, in hyperthyroidism, in heart block with a very slow heart rate, and in sclerosis of the aorta and its large branches.

Persons exhibiting systolic hypertension often have heart disease. The anesthetic used for them should be one which is not injurious to the heart. It should not increase the peripheral resistance offered the heart on emptying by producing generalized vasoconstriction. Anesthetic agents known to be least toxic to the heart are ether, ethylene, and cyclopropane. Anoxemia is a serious cardiac depressant and must be avoided. The slow intravenous administration of glucose, 10 per cent, is often beneficial, particularly in hyperthyroidism. Increased peripheral resistance can be avoided by eliminating excitement through careful preoperative handling of the patient. Preoperative medication with morphine or a barbiturate aids also. During induction an excitement stage should be avoided. This can be accomplished by using pentothal sodium or an appropriate gas anesthetic initially and then switching to ether if necessary. Ether alone is not desirable for induction because of the length of time required and because of the likelihood of producing excitement. For the patient with hyperthyroidism a basal anesthetic given in his room may be desirable.

The postoperative use of oxygen is recommended when the cardiac status is depressed. In hyperthyroidism, until all signs of toxicity or increased temperature have subsided, the use of whole adrenal cortical hormone, 3 to 10 cc. daily, is recommended because of its influence in helping to maintain the liver glycogen level.

Diastolic hypertension occurs in hypertensive disease, so-called essential hypertension, in diffuse glomerulonephritis, in hypertensive disease of pregnancy, in

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*Department of Surgery, Washington University School of Medicine, and Barnes Hospital; Recipient of a grant-in-aid of research from the Commonwealth Fund.

polycystic renal disease, in pyelonephritis, in amyloid contracted kidneys, in coarctation of the aorta, in periarteritis nodosa, in adrenal medullary or cortical tumors, in hypothalamic disease, and in renal arterial obstruction.

In these diseases, diastolic hypertension usually represents a homeostatic response on the part of the body to overcome a threatened deficiency of the renal circulation. It follows that, when such a deficiency is due to a functional or occlusive narrowing of the renal arteries, the blood pressure should not be decreased rapidly to avoid sudden renal deficiency. Associated with diastolic hypertension there is a narrowing of the peripheral arterioles with an exaggerated heart action sufficient to maintain a normal cardiac output in spite of the increased peripheral resistance. Early in diastolic hypertension there is little or no disease of the heart, of the lungs, or of the blood vessels. Later in the disease the functional narrowing which characterizes the early stages is replaced by occlusive narrowing of the blood vessels, particularly of the heart, of the kidneys, and of the brain. It is the development of this arteriolar sclerosis which is responsible for the disease in these vital organs. Disease of the heart is recognized by functional weakness such as shortness of breath and by electrocardiographic changes. Disease of the kidneys reveals itself by the presence of albumin, casts, or red blood cells in the urine and particularly by an elevation of the nonprotein nitrogen content of the blood. Disease of the brain arteries cannot always be discovered, but any marked changes in the blood vessels of the eyegrounds suggest the possibility of damage to the arteries of the central nervous system.

The anesthetist, then, is free to consider the patient with early diastolic hypertension as being essentially a normal individual from the standpoint of anesthesia. It is necessary only to guard against a severe decrease in blood pressure and the use of anesthetic agents which are toxic to the heart, the kidneys, or the central nervous system. Operations should be as brief as possible, and throughout anesthesia anoxemia must be avoided. For patients with late diastolic hypertension all precautions known to protect the heart, the kidneys, and the brain must be employed to the fullest extent.

Spinal anesthesia is not considered the anesthesia of choice for patients with hypertension because it may cause a drop in blood pressure. If spinal anesthesia is used, anesthesia levels should not extend above T_5 to T_{10}. The preoperative use of vasoconstrictor drugs at least thirty to forty minutes before operation is mandatory. Glucose, 10 per cent, or blood should be used intravenously to maintain the blood pressure at preoperative levels. Oxygen should be given throughout the procedure.

Postoperatively, a severe decrease in blood pressure must be avoided by the intravenous administration of fluids or blood, by elevation of the foot of the bed, and, if necessary, guarded use of vasoconstrictor drugs.

MECHANISM OF ANESTHESIA IN THE NERVOUS SYSTEM

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The unit in the structure of the nervous system is the nerve cell with its dendrites and its axon. The nerve cell is trophic both to the dendrites and to the axon. With activity, impulses travel along the axon of one cell to activate the dendrites of another cell. The region of contact between the axon terminals and the dendrites is spoken of as a synapse. The nervous system is composed of afferent, efferent, and interneuron units. The afferent units carry impulses into the central nervous system from the body generally. The interneuron units which represent all the connections in the central nervous system between the termination of the afferent neuron and an efferent neuron are excited to activity or modified in their spontaneous activity by such impulses. Impulses over the terminal interneuron unit excite efferent or motor units into activity or modify the activity of the organs and tissues which constitute the body.

Some neurons, such as the dorsal root T ganglion cell, are active only when stimulated. Their cell bodies probably are trophic only in their function, the axon conducting past them with activity. Others of the interneuron type may be inactive except when stimulated, and still others of this type are constantly or periodically spontaneously active. Their activity, however, is subject to modification by impulses received from afferent or other interneuron units. The efferent neurons within or without the central nervous system on excitation activate such structures as muscles and glands.

The susceptibility to depression by anesthesia of the nerve cell, the axons, and the synapse differs widely. The order of their depressibility is the synapse, the nerve cell, and finally the axon. To effect clinical anesthesia of all degrees the synapses alone need to be blocked. The nerve cells under clinical anesthesia may be depressed slightly, but the axon is not depressed at all. Anesthesia consists essentially in the blocking of synapses within the brain and the spinal cord. These facts afford the basis for the rather wide difference between the degree of depression which produces anesthesia and that which causes death.

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The susceptibility of synapses to depression by anesthesia differs in two important respects. There is a difference in the susceptibility of synapses associated with the different fiber types as well as a difference in susceptibility of synapses at the different levels of the nervous system. It has been established that the fiber components of a peripheral nerve vary in size and in axon type. Large myelinated fibers convey impulses which travel at 100 to 30 meters a second. On activation they give rise within the central nervous system to touch and to pressure experiences. Smaller myelinated fibers with impulses traveling 30 to 8 meters a second give rise to pain and to co-ordinated reflexes. There are smaller myelinated fibers for temperature sense and nonmyelinated fibers with slow acting axons which travel 1 to 0.5 meters a second. Activity in these gives rise to the sensation of pain also. They are associated with the production of diffuse reflex action. When the fibers reach the central nervous system they synapse with the dendrites of interneuron cells in the brain and in the spinal cord. Under anesthesia the synapses of the fibers of different sizes are differentially susceptible to blocking. The synapses of the fibers giving rise to pain of the type which is associated with diffuse reflexes are blocked before those causing the type of pain which is associated with co-ordinated reflexes. The synapses of the latter fibers are blocked before the synapses of the fibers whose activity is associated with the experience of touch and pressure. This differential depressibility at the synapses associated with the various sensory modalities may be assumed to be g e n e r a l throughout the various levels of the nervous system.

It has been established that the different levels of the central nervous system, the cortical association areas, the sensory areas, the motor areas of the cortex, the basal ganglia, the hypothalamus, the midbrain and pons, the caudal reticular area in the region of the respiratory center, and finally the spinal cord are depressed differentially by anoxia in the order stated. Activity in the gray matter of the cervical and lumbar cords may show a tremendous increase at a time when the association areas of the cortex are depressed. This manifests itself by rigidity in the patient.

SUMMARY

In summary, it may be stated that anesthesia is effected essentially by depression at the synapses. Under such circumstances the degree of depression of nerve cells exhibiting spontaneous activity need be slight if any, and the fibers which conduct impulses throughout the nervous system are not depressed at all. Synapses associated with the various modalites of sensation are depressed differentially as are the synapses of the various levels of the entire nervous system itself.

ANESTHESIA IN SURGERY FOR TUBERCULOSIS

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The recent advances in thoracic surgery have been so spectacular that the age old problem of tuberculosis has, not infrequently, been forgotten for a time. None the less, there are now at least 500,000 cases of active tuberculosis in this country.[1] Also, over 100,000 new cases are being reported each year. In 1946 there were 50,000 deaths attributed to tuberculosis. It is obvious that not all these patients will come to surgery, but those who do should be considered distinctly different from all other surgical patients in that the usual anesthetic agent must be introduced into the body via the lungs, the seat of the disease. Reference is made to the secondary effects of the anesthesia rather than to the harmful effects of the agent on the tuberculous lung. There is no definite evidence that any anesthetic agent now in use is harmful to the lung affected by tuberculosis.

Surgeons have become more bold in their attack on tuberculosis since the discovery that streptomycin will retard the progress of the disease in certain patients. However, it must not be concluded that the basic principles of good surgery for tuberculosis have been discarded in favor of a "wonder drug." The principles include proper preparation of the patient for surgery, the performance of the operation at the optimal time, and the prevention of spread of the disease from causes that can be controlled. The administration of an anesthetic for such operations can cause a spread of the disease and is one of the phases of caring for the patients that can be varied so that the risk is minimal. It is the purpose of this discussion to review the responsibilities of the anesthetist and the surgeon in aiding to prevent complications.

Preoperative Preparation

The chronic nature of tuberculosis allows one the time necessary to prepare the patient carefully for surgery. Thus, the patient is generally in good physical condition. This preparation may consist merely of adequate rest and a high protein diet with vitamin supplements, or it may include some minor surgical procedure such as temporary phrenic nerve interruption or division of adhesions hindering collapse for a good pneumothorax. The patient is permitted to get out of bed preoperatively (if he has not been up and about) and between

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*John Harper Seeley Fellow in Surgery; from the Department of Surgery, University of Michigan Medical School.

1. Statistical Bulletin, Metropolitan Life Ins. Co. 28: 1-3, 1947.

stages of the surgical treatment, so as to aid in stabilization of vasomotor tone.

After the surgeon and his medical colleague have done their part to have the patient in as good a physical and mental state as possible under the circumstances, the anesthetist can carry on with this preparation in the anesthesia room. Because of the fact that the patient has been in a sanatorium prior to surgery and has seen good results from surgery on other patients, he is not often emotionally upset. However, not infrequently, offhand remarks and unnecessary roughness in positioning will do much to bring on a stormy induction period. It is of prime importance that every patient be made to undergo postural drainage for at least fifteen minutes prior to induction of anesthesia. This may be accomplished by elevating the foot of the cart or by transferring the patient to the operating room table and lowering the head end 10-15 degrees. The patient is then instructed to breathe deeply at intervals and attempt to evacuate secretions in the tracheobronchial tree. After the induction period, the efficient anesthetist will adjust the patient's position so that braces, pillows, and sand bags needed to keep the patient in position do not hinder adequate pulmonary ventilation. In our experience intratracheal tubes are necessary only for intrathoracic surgery. For thoracoplasty an adequate air passage is maintained without difficulty by using the ordinary hard rubber airway.

ANOXIA

One of the major difficulties with these patients is that in addition to the prolonged bed rest the pulmonary parenchymal involvement further decreases the vital capacity and oxygen uptake so that anoxemia is especially likely to develop if one is not constantly on guard to prevent or overcome it at once. It behooves every anesthetist to have a thorough understanding of the effects of anoxia since these patients tolerate the condition poorly. In the early days of thoracic surgery, cardiac failure was listed as a common cause of death both during and after the operation. In the light of present knowledge, we know that the cardiac condition was not the main cause. As yet, it is not recognized often enough that the patient who has a stormy recovery from anesthesia is probably suffering from cerebral anoxia. This patient may even be given a sedative for restlessness instead of high concentrations of urgently needed oxygen. Thus, as Maier[2] puts it, "a thoracic surgeon can only view with alarm any period of cyanosis during a thoracic operation."

Adequate pulmonary ventilation is of paramount importance. Unfortunately, during most of the operation the patient must lie on his so-called "good side." Together with the surgical procedure being done, this further decreases the vital capacity. It also places the major role in respiration on the lung which is

2. Maier, H. C.: Responsibility of the anesthetist in reducing the operative complications of thoracic surgery. Anesthesiology 5: 11-21, Jan. 1944.

directly beneath the diseased lung from which varying amounts of secretions containing large numbers of tubercle bacilli will pour forth. The commonest cause of inadequate pulmonary ventilation is obstruction of the airway. The obstruction may not be sufficient to cause visible cyanosis, but it does lead to increased negative pressure within the smaller bronchioles during forced inspiration. It is a physiologic fact that such negative pressure excites the production of a transudate which, under the circumstances, pours out into the alveoli and bronchioles, leading to pulmonary edema, and may cause severe anoxia. Since the fluid exists in the alveoli and small bronchioles, it is most difficult to remove by aspiration. This may result in bronchopneumonia or atelectasis. This fluid together with the secretions already present aids in the transportation of tubercle bacilli to another part of the parenchyma as yet uninvolved. The anesthetist, by comparing the movement of the breathing bag with the excursion of the chest wall, can accurately estimate pulmonary ventilation and should call the surgeon's attention to any great discrepancy.

Thoracic surgery requires closer co-operation between the surgeon and the anesthetist than most other types of surgery.[3,4,5] This is especially true of intrathoracic procedures. Dissection in the region of the pulmonary hilus sets in motion a train of reflexes which have on occasion caused death due to the severe effect on circulation and respiration. Therefore, a local anesthetic is usually injected around the hilus prior to dissection there, to interrupt these nerve impulses which originate in the vagus or sympathetic nerves. Motion of the mediastinum, or so-called "flutter," not only makes dissection extremely difficult and dangerous but also can initiate these same reflexes. Therefore, the anesthetist should arrange matters so she can observe the motions of the diaphragm and mediastinum and then adjust the plane of anesthesia accordingly. If the surgeon neglects to use local anesthesia in the hilar structures and the anesthetist notes the reflex effects on the heart and respirations, it behooves her to call the attention of the surgeon to the condition at hand.

The handling of the lung, which is necessary in intrathoracic surgery, further adds to the amount of secretions forced out into the trachea and possibly over into the good lung. The placement of the patient in at least a 10 degree Trendelenburg position will facilitate the flow of secretions toward the mouth. This, plus the face-down position popularized by Overholt, may prevent some complications from excessive secretions in the tracheobronchial tree. Since the anesthetist has, by means of the anes-

3. Alexander, John: *Collapse Therapy of Pulmonary Tuberculosis* (Springfield, Ill.: Charles C Thomas Co., 1937) Chap. XXII, p. 443.

4. Etsten, Benjamin: Anesthesia for thoracic surgery. New York State J. Med. 43: 1980-1985, Oct. 15, 1943.

5. Eversole, U. H., and Overholt, R. H.: Anesthesia in thoracic surgery. J. Thoracic Surg. 5: 510-521, June 1936.

thetic agent, abolished the cough reflex, it becomes her responsibility to see that secretions are removed by aspiration of the trachea, pharynx, and mouth. If, in spite of continued aspiration, more secretions continue to pour forth and it is apparent that the patient is drowning, so to speak, the anesthetist must tell the surgeon that it would be best to terminate the operation as rapidly as is feasible. Also, if secretions are present after adequate aspiration, the anesthetist should inform the surgeon that it is not possible to remove the secretions with the facilities she has and that, in her opinion, bronchoscopy is indicated.

The removal of too many ribs may lead to excessive paradoxical motion of the chest wall. By this is meant loss of elevation of the chest wall during inspiration or actual sinking in the chest. This permits the lung underlying this area to be in expiration while the rest of the pulmonary parenchyma is involved in inspiration. Thus, expired air and secretions from the collapsed part of the lung are inhaled to other portions of the lung, leading to further hypoxia or the inoculation with tubercle bacilli of parenchyma not yet involved.

ANESTHETIC AGENT

The choice of anesthetic agent is still a moot point. It is our practice in intrathoracic operations to use nitrous oxide-oxygen for induction and oxygen-ether for maintenance, after an intratracheal tube has been placed in position under local anesthesia. For thoracoplasty I favor nitrous oxide for induction and oxygen-ether for maintenance. I concur with Beecher's[6] opinion that a competent anesthetist can have a patient awake as easily after ether anesthesia as after cyclopropane anesthesia. Cyclopropane not only sensitizes the myocardium to epinephrine but also causes marked vasodilatation which leads to excessive blood loss. The hypertension which is maintained with cyclopropane anesthesia gives one a false sense of security, realized only when the usual abrupt decrease in blood pressure occurs at the termination of the anesthesia. Recent work in the pharmacology laboratory of the University of Michigan by Dr. Gordon Moe revealed that cyclopropane also sensitizes cardiac muscle to changes in intraventricular pressure and leads to cardiac irregularities.

MORTALITY

According to Adriani,[7] the termination of anesthesia and the recovery period are as dangerous as the induction period. Death during anesthesia or shortly thereafter is more common than is generally believed. Waters[8] and Gillespie,[9] in separate studies in 1944, reported that the percentage is about one death in 1,000 anesthetics. Too frequently the members of the surgical team relax their vigilance once the skin is closed and bandaged, and the patient is left in the care of inex-

6. Beecher, H. K.: Anesthesia for thoracic surgery. J. Thoracic Surg. 10: 202-219, Dec. 1940.
7. Adriani, John: Some hazards of anesthesia. New Orleans M. & S.J. **98**: 324-330, Jan. 1946.
8. Waters, R. M., and Gillespie, N. A.: Deaths in the operating room. Anesthesiology **5**: 113-128, Mar. 1944.
9. Gillespie, N. A.: Death during anesthesia. Brit. J. Anaesth. **19**: 1-16, Jan. 1944.

perienced persons. The forgetful anesthetist neglects the patient to complete the chart or attend to comparatively trivial chores, such as preparing for the next case. Most surgeons are in agreement with Adriani,[7] who states further that the anesthetist should observe the patient closely until all reflexes have returned so that the possibility of complications has passed. Much may be learned by the anesthetist from a visit to the patient the day after operation. The anesthetist should not be as once described, "a person with a rag and a bottle who appears at the last possible moment before the operation and disappears at the first opportunity after having, in the meantime, kept the patient somewhere between vomiting and death during some surgical procedure."

Macintosh and Bannister[10] appropriately stated that the anesthetist always has three persons to satisfy: the patient, the surgeon, and herself. It is hoped that she will never succeed in satisfying herself completely even though she can succeed in satisfying the patient. However, if she is fortunate, she may even be able to satisfy the surgeon with whom she co-operates.

Summary

1. Patients with tuberculosis are classed in a distinctive group since the organ that absorbs the anesthetic is involved by the disease process.

2. Anoxia, adequate pulmonary ventilation, and detrimental mediastinal nerve reflexes have been discussed. The anesthetist should thoroughly familiarize herself with these subjects.

3. The induction of, and recovery from, anesthesia are equally important phases of the administration of an anesthetic.

4. Ether is probably the best anesthetic agent thus far available for surgery for tuberculosis.

5. The anesthetist who is cognizant of surgical procedures insofar as they affect the anesthesia is better able to establish good rapport with the surgeon.

6. The surgeon who recognizes the difficulties incident to the anesthesia will be able to cooperate better with the anesthetist.

7. The responsibilities of the anesthetist and surgeon in preventing complications in tuberculous patients who need operations have been reviewed.

7. Adriani, loc. cit.

10. Macintosh, R. R., and Bannister, Freda B.: *Essentials of Anesthesia*, 1943; cited by Rix, H. G.: Anesthesia in intrathoracic surgery. New Zealand M. J. **45**: 490-498, Oct. 1946.

ARTERIAL OXYGEN

(*Continued from page* 190)

degree of oxygenation of the blood should simplify the anesthetist's problem. It should provide an accurate and immediate indicator of developing oxygen lack so that anoxemia may be prevented or at least minimized. Thus, the oxyhemograph may become an instrument of practical value, which may be an additional aid to the nurse anesthetist in raising the quality of her anesthesia to an even higher level than the excellent standards which are now maintained.

APPLICATION OF REGIONAL ANESTHESIA IN TREATMENT OF ECLAMPSIA AND PRE-ECLAMPSIA

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Eclampsia is still "the disease of theories." There are a considerable number of facts to support the most acceptable theories, but no one of them completely explains all of the factors in eclampsia; the cause of eclampsia is still unknown. Some progress has been made in reducing the incidence of this death-dealing complication in obstetrics by properly conducted prenatal care. However, we cannot expect to eradicate the disease until we know its cause.

Some advance has been made in the study of the pathology of eclampsia, and it is now generally recognized that generalized vasoconstriction, perhaps affecting the kidneys, is present in a large number of cases.[1,2,3,4] The vasoconstriction, whatever its cause may be, results in hypertension and in changes in the eyegrounds and kidneys; at least these are the major effects with which we have to deal. The progress of a case of eclampsia can be followed by observing the changes in the retinal arteries.[5,6,7,8,9]

Vasoconstriction in the kidneys reduces the blood flow in the kidneys and according to

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‡Resident in Obstetrics and Gynecology, St. Joseph's Hospital.

1. Irving, F. C.: A study of 500 consecutive cases of pre-eclampsia. Canad. M.A.J. **40**: 137, 1939.
2. Mussey, R. D., and Hung, A. B.: The late toxemias of pregnancy. Surg., Gynec. & Obst. **66**: 550, 1938.
3. Peters, J. P., and Zimmerman, H. M.: The role of pyelitis in the production of the toxemias of pregnancy. Tr. A. Am. Physicians **51**: 287, 1936.
4. Whitacre, F. E.: Loeb, Wm. M., Jr., and Chin, H.: Contribution to the study of eclampsia; consideration of 200 cases. J.A.M.A. **133**: 445-449, Feb. 15, 1947.
5. Hallum, A. V.: Retinal arterioles in hypertension of pregnancy. Tr. Am. Ophth. Soc. **43**: 585-607, 1945.
6. Hallum, A. V.: Changes in retinal arterioles associated with the hypertensions of pregnancy. Arch. Ophth. **37**: 472-490, April 1974.
7. Volhard: Die Pathogenese der Retinitis Albuminurica. Zentralbl. f. d. ges. Ophth. **21**: 129-137, March 1929.
8. Wegener, H. P.: Arterioles of the retina in toxemia of pregnancy. J.A.M.A. **101**: 1380-1384, Oct. 28, 1933.
9. Mussey, R. D.: Relation of retinal changes to severity of acute toxic hypertensive syndrome of pregnancy. Am. J. Obst. & Gynec. **31**: 938-946, June 1936.

Way[10] results in (a) avascular glomeruli followed by (b) an increase in endothelial cells in the glomerular capillaries and (c) finally in thickening and swelling of the glomerular capillary basement membrane, in this order of increasing severity. Fahr, Bell and others have made similar observations.[11] Death may occur in any of the aforementioned stages of kidney involvement; however, it is obvious that the sooner relief is obtained, the better the prognosis for the patient.

The vasospasm also affects the adrenal glands[10] in such a way as often to lead to hemorrhage into these structures with the production of adrenal insufficiency. This accounts for the cases of eclampsia in which the patient goes into mild or severe shock a short time before death. The liver and the brain also undergo important changes; as a matter of fact, the entire body is affected by the generalized vasospasm.

MORTALITY RATE

Until the advent of regional block anesthesia, the treatment of eclampsia remained practically unchanged for many years and consisted in (1) elimination, (2) dehydration, and (3) sedation. The methods of producing these effects in the treatment of eclampsia have been numerous and varied, but the mortality rate in this country has been approximately 5-30 per cent, averaging 13 per cent in the hospitals of the United States for the year 1946.[12] In the John Gaston Hospital in Memphis, from 1936 to 1942, the maternal mortality rate was 26 per cent according to Hingson[12]; however, from 1933 to 1945 inclusive the mortality rate was 18.5 per cent.

With the employment of regional block anesthesia, Hingson[12] reported 31 consecutive cases with one death, or a maternal mortality rate of 3.2 per cent, this one patient having had a cerebral accident prior to the onset of treatment. This is truly a remarkable result. At St. Joseph's Hospital, Memphis, in the last half of 1947, we had six cases of eclampsia in which treatment was by regional block anesthesia with prompt recovery in each case, and each mother gave birth to a living child. The effect is so dramatic as to astonish the clinician who has been forced to treat eclampsia by the less satisfactory methods heretofore known. During the same period at St. Joseph's Hospital, we also had six cases of severe pre-eclampsia managed by regional block anesthesia without any of the patients going into the eclamptic state and with all six recovering. One of the babies was a dead macerated fetus.

We still use treatment by elimination, dehydration, and sedation in these cases in connection with regional block anesthesia. The cases herein reported exemplify this effect and show how promptly these patients recover.

10. Way, Geo. T. C.: Eclampsia, a clinical and anatomical correlative study. Am. J. Obst. & Gynec. 54: 928, 1947.

11. Crabtree, E. E.: *Urological Diseases of Pregnancy* (Baltimore: Williams & Wilkins Co., 1942).

12. Hingson, R. A.: From a paper read before the International Congress of Anesthesia, Sept. 1947, to be published.

URINE OUTPUT IN CASE 22531-1947

	HOURS	INTAKE	OUTPUT
		cc.	cc.
Before delivery	12	2,800	500
	6	510	350
	10	Not recorded	Not recorded
	8	1,000	500
After delivery	6	630	600
	6	1,230	2,500
	6	620	1,000
	6	900	1,400
	6	1,220	2,200
After discontinuance of spinal anesthesia	6	1,000	1,800
	6	1,060	1,050

CASE REPORTS

CASE 22531-1947.—The patient was admitted to St. Joseph's Hospital on October 13, 1947. She was a primipara, aged 19, whose normal weight was 103 pounds. Total weight gain had been 19 pounds. The patient had received antepartum care from her local physician before admission. She had been given magnesium sulfate by mouth and placed on a dietary regimen. The blood pressure gradually increased in the last trimester, with several headaches for the last three weeks. Blood pressure reached 200 systolic and 130 diastolic. There was no edema.

On admission the blood pressure was 220 systolic and 150 diastolic. The patient was conscious with moderate headache. There was no edema. Albumin was 4 plus; nonprotein nitrogen 28.5 mg.; total protein 7 Gm.; albumin ratio 1.5:1.

Conservative treatment was started, and magnesium sulfate, 10 per cent, was administered intravenously. The blood pressure dropped to 160 systolic and 70 diastolic, and the patient promptly had three convulsions. These convulsions began two hours after she was admitted to the hospital. Nembutal, 3½ gr., was given intravenously for sedation. Continuous catheter spinal anesthesia, according to the Touhy method, was instituted, and 0.75 cc. metycaine (approximately 12 mg.) was given. The blood pressure decreased from 170 systolic and 130 diastolic to 70 systolic and 40 diastolic in about three minutes. The patient's feet were elevated at a right angle to her body, and the blood pressure increased to 130 systolic and 90 diastolic.

The patient went promptly into labor. The membranes ruptured, and under saddle block anesthesia with 2 cc. glucose and metycaine mixed in equal parts, the patient was delivered by low forceps and episiotomy, of a normal living child, whose cry and respiration were spontaneous.

After delivery, the anesthesia was maintained on a 2 cc. dosage of metycaine (30 mg.), as indicated, for thirty-three hours, the blood pressure being kept below 170 systolic and 100 diastolic. The patient was then given sedation, and the spinal anesthesia was discontinued. While she was under the influence of saddle block anesthesia, she was given mild sedation, hypertonic glucose, and adequate fluids.

On admission there was 650 cc. of urine in the bladder, which showed 4 plus albumin and 4 plus red blood cells. The urine output is recorded in the table.

After discontinuance of the catheter spinal anesthesia, the blood pressure was somewhat elevated, fluctuating between 140 and 160 systolic over 80 to 100 diastolic. On the last two days in the hospital, the sixth and seventh days postpartum, the blood pressure was 110 to 130 systolic over 60 to 70 diastolic. Convalescence was uneventful, and the mother and baby were discharged on the seventh day postpartum.

CASE 2997-1948.—The patient was admitted to St. Joseph's Hospital on March 13, 1948, with a history of having gained 30 pounds during pregnancy, 12 to 14 pounds having been gained in the last four weeks. Edema and an elevated blood pressure had been present for two weeks; the blood pressure reached 190 systolic and 110 diastolic before she left home.

On admission the blood pressure was 180 systolic and 110 diastolic with 3 plus pitting edema of the lower extremities. Urinalysis showed a heavy trace of albumin and 25-30 red blood cells. Red blood cell count was 4,760,000 with 72 per cent hemoglobin (10.5 Gm.), 8,100 white blood cells with 82 per cent polymorphonuclear leukocytes. Total protein was 6.4 Gm. The patient was placed on a fruit juice and milk diet, salts by mouth, and sedation. She lost 6 pounds in the first three days, and the blood pressure was gradually reduced to 142 systolic and 88 diastolic.

At 2 p.m. on March 15 the patient went into labor, and her blood pressure increased to 190 systolic and 110 diastolic. At 3 p.m. Touhy catheter spinal anesthesia was instituted, the blood pressure being 195 systolic and 120 diastolic. The blood pressure gradually decreased under catheter spinal anesthesia to 135 systolic and 90 diastolic for the next six hours, gradually increasing at the time of delivery to 150 systolic and 100 diastolic. The catheter spinal anesthesia was continued for three hours longer, during which time the blood pressure decreased to 158 systolic and 100 diastolic, 136 systolic and 90 diastolic, and finally to 120 systolic and 60 diastolic. The urine at the time of delivery showed a faint trace of albumin. After delivery the red cell count was 4,360,000 with 87 per cent hemoglobin (12.7 Gm.). The convalescence was uneventful. The edema completely disappeared, and the blood pressure was stabilized around 120 systolic and 80 diastolic to 130 systolic and 80 diastolic.

No record was kept of the urine output previous to the institution of spinal anesthesia. The first nine hours after continuous spinal anesthesia was instituted, the intake was 1,600 cc. with an output of 1,450 cc. For the next six hours, the intake was 900 cc. and the output 1,250 cc. After the catheter spinal anesthesia was discontinued, the urine output for the first twenty-four hours was 2,000 cc. and for the next twenty-four hours 2,650 cc.

MANAGEMENT OF ANESTHESIA

The nurse anesthetist should have a definite interest in this problem. In an increasing number of cases, the nurse anesthetist will be called upon, not to do the spinal puncture or institute caudal anesthesia or other forms of regional block anesthesia, but to assist in the procedure. It is for this reason, that I call the attention of this group to this problem.

With the onset of regional block anesthesia, we achieve the following results:[13]

1. Maximal vasodilatation of the vessels of the lower extremities, enormously increasing the capacity of this vascular bed and effectively withdrawing approximately 800 cc. of blood from the general circulation, thereby reducing the circulating blood volume and the "load"

13. Lull, C. B., and Hingson, R. A.: *Control of Pain in Childbirth*, ed. 2 (Philadelphia: J. B. Lippincott Co., 1945) p. 289.

on the heart and pulmonary circulation.

2. Block of the vasoconstricting elements to the kidney, which allows more blood to flow through the kidney, resulting in increased urinary output in these potentially anuric patients and preventing further kidney damage.

3. Denervation of the adrenal glands and release of spasm in these organs, which prevent anoxemia and hemorrhage with its resulting adrenal insufficiency and also help to decrease the blood pressure.

These three factors result in a further decrease in blood pressure. This condition can be maintained for hours with the continuous type of block anesthesia, either spinal or caudal.

Occasionally, the decrease in blood pressure becomes excessive but can be quickly remedied by:[14]

1. Elevating the legs at a right angle to the body; this forces the 800 cc. of blood pooled in the lower extremities back into the general circulation.

2. Continuous oxygen inhalation to combat the anoxemia in the mother due to the induced hypotension and particularly to protect the baby by supplying it with adequate oxygen until the mother's blood pressure can be increased to safe levels, but still below the dangerous level existing before treatment was instituted.

3. Administration of a vasoconstrictive drug such as ephedrine, methedrine, or neosynephrin.

Occasionally, the excessive decrease in blood pressure may be associated with collapse and respiratory failure, but these complications can usually be successfully combated by the described measures plus artificial respiration. Occasionally, also, toxic effects of the drugs used, mainly nervous manifestations, arise and can be combated by decreasing the dose or by using another drug.

Only by constant supervision of the patient, regulation of and changes in the dosage of the drug used, and observation of the blood pressure at repeated intervals can this method be as safe as we desire. Someone competent to make these observations and institute treatment for complications, if and when they arise, should always be at hand.

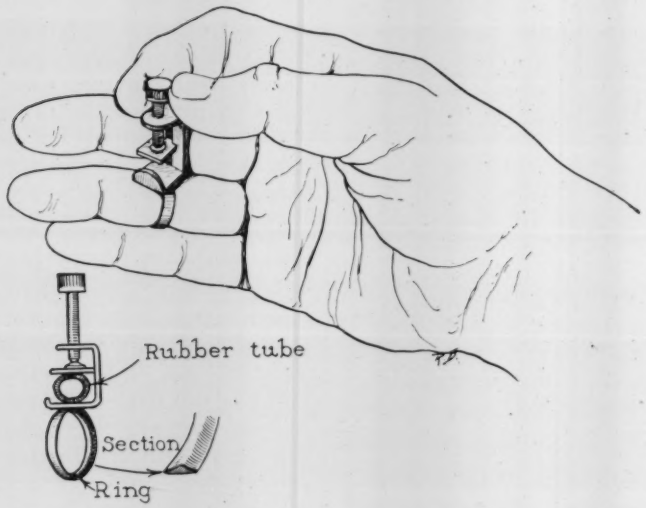
SUMMARY

In my opinion, the nurse anesthetist trained in regional anesthesia will play an important part in the success or failure of this particular treatment as it becomes more widely used. The success we have had in Memphis with this treatment of eclampsia has been so encouraging that we believe it is the best treatment at this time for eclampsia gravidarium.

14. Ibid. p. 325.

NOTES

When anesthetists get together, they talk about anesthesia. They talk about gadgets, special technics, and interesting cases. This section of NOTES was originated so that anesthetists could exchange ideas in writing as they do in conversation. Send in your contribution now. Other anesthetists will be helped by it.



Ring Pinch Clamp.—An improved ring pinch clamp, made of stainless steel, has been devised.[1] Instead of the standard 24 threads to the inch, the new clamp has 48 threads and permits fine adjustment of the rate of flow of fluids. A ring through which one finger may be inserted acts as a stabilizing base, making it possible to use only one hand for the adjustment, an obvious advantage to anesthetists.

1. Proc. Staff Meet., Mayo Clin., Feb. 20, 1946.

Refrigeration Anesthesia in Nursing Procedures.—The principle of refrigeration in anesthesia is usually applied to procedures involving the extremities. Two uses of refrigeration which may be useful in nursing procedures are suggested.

1. When patients are subjected to repeated subcutaneous or intramuscular injections, they may become hypersensitive to the insertion of the needle. By plac-

ing an ice cube for a few minutes on the skin at the site of injection, numbness of the skin results, and the pain of injection is reduced.

2. Drinking obnoxious medicines, such as castor oil, may be made easier if the patient is allowed to hold a piece of ice in his mouth for several minutes before drinking the chilled medicine.

A.A.N.A

(*Continued from page* 176)

best service to patients and surgeons, and (2) in the direction of solidifying the internal structure and organization of the Association. In other words, we have brought the individual anesthetist and the organization to the point that they can stand on their own feet, that they can be independent and at the same time interdependent. Now is the time for us to plan for nurse anesthetists working through this association to step out and become articulate active members in society. Now is the time for us to plan to become citizens, and to assume the privileges and obligations of citizens in the total society offering medical service. As individuals and as an association, we must find means of cooperating with nurses, individually and through their associations, with physicians, individually and through their associations, and with hospital administrators, individually and through their associations. When the day comes that our successors can add the realization of that objective to the past accomplishments of nurse anesthetists and the Association, then we shall truly have come of age.

DEATHS

Mary Conoly Brown, former secretary-treasurer of the Florida Association of Nurse Anesthetists, died on March 2, 1948, at Pratt Veterans' Hospital, Coral Gables, Florida. She was a graduate of Thompson Hospital Training School for Nurses, Lumberton, North Carolina. She enlisted in the Army Nurse Corps and saw service in France and England during World War I. She received specialized training in anesthesia at the Howard Hospital, Philadelphia. As nurse executive and nurse anesthetist she served as assistant superintendent and superintendent of hospitals in Orlando, Lakeland, Gainesville, and Bartow, Florida, and for the last eleven years in the anesthesia department of Jackson Memorial Hospital, Miami.

Christian Kempton, a member of the Michigan Association of Nurse Anesthetists, died on June 15, 1948, in Goderich, Ontario, Canada after an eight months' illness. Miss Kempton was a member of the department of anesthesia at Florence Crittenton Hospital, Detroit, for eleven years, and of the department of anesthesia at the Henry Ford Hospital, Detroit, for five years.

LEGISLATION

Emanuel Hayt, LL.B*

THE ANESTHETIST MUST EXPLAIN.—In New York a patient brought suit for a burn received on her back while she was a patient in a charitable hospital.[1] The burn was not on an area of the body upon which the operation was performed. There was no explanation given to the patient as to why the burn should have occurred in the operating room while she was under anesthesia.

The court held that the patient was entitled to an examination of the anesthetist and the other persons who were in the operating room at the time of the accident. Thereupon it would be the burden of those being sued to come forward with evidence in explanation of their conduct.

Unless this doctrine were applied by the courts, it would be impossible for a patient, injured while unconscious, to prove the cause of an accident or injury, in order to establish fault.

DEATH FROM ALLERGY NOT NEGLIGENCE.—The parents of a 9 year old girl in Washington brought an action to recover damages for her death, which occurred while she was under anesthesia during an eye operation.[2]

The child had been given the usual preoperative tests at the hospital and was taken into the operating room. The anesthetic, ether, was administered by the nurse anesthetist in the employ of the hospital. During the operation the surgeon and the nurse noticed that the child had become cyanotic. He immediately stopped the operation and passed to the other side of the drape to look at the child, who was not breathing. This was the first and only sign that anything abnormal was occurring. Efforts were immediately begun to resuscitate her. Other doctors were called in to assist, but all efforts were in vain.

An autopsy revealed that the death was caused by an allergy to ether of the thymus gland. According to the evidence, there is no known test to ascertain such an allergy prior to the time that ether is administered.

The action was dismissed by the court, as it was not shown that there was any negligence which was the proximate cause of the death. Death resulted from an independent cause, an allergy, which was unforeseeable.

CHILD'S DEATH OF ATELECTASIS.—An 8 month old child in California smothered while unconscious after a minor operation at a hospital. The parents alleged negligence in the failure to watch and protect the child while unconscious and under the influence of a general anesthetic. Death was due to atelectasis.[3]

The court held that it was the duty of the hospital to use rea-

*Counsel for A.A.N.A.

1. Pliss v. 83rd Foundation, 69 N.Y.S. 2d 727.

2. Yeager v. Dunnavan, 174 P. 2d 755 (Wash.).

3. Thomas v. Seaside Memorial Hospital, 183 P. 2d 288 (Cal. App.)

sonable care and diligence in safeguarding a patient committed to its charge, and such care and diligence are measured by the capacity of the patient to care for himself. By reason of the child's tender age, the hospital owed a higher degree of care in attending it than if she had been an adult.

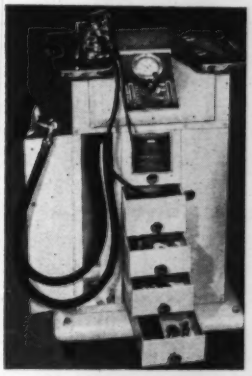
GENERAL ANESTHESIA IS MEDICAL PRACTICE.—A licensed chiropodist was convicted of manslaughter in Wyoming. He had injected 3 cc. of a 5 per cent solution of sodium pentothal into a vein in a patient's left wrist to anesthetize him so as to reduce a dislocated shoulder. Cyanosis progressed to a dangerous stage; a physician was called. No stimulants or artificial respiration had been given prior to that time. The patient's heart was then beating weakly, and his voluntary reflex action had stopped. Efforts to revive the patient by artificial respiration, pulmotor, picrotoxin, and epinephrine were in vain. Autopsy showed death to be due to respiratory failure with coronary sclerosis, moderate.[4]

The statute authorized chiropodists to use only local anesthetics. A man who has only a limited education in medicine, said the court, is not competent to give a general anesthetic; the administration thereof is intended to be left to a person with greater knowledge of the frailties of the human system. The jury has the right to say that one who practices medicine without a license and causes the death of a patient is guilty of criminal negligence.

4. State v. Catellier, 179 P. 2d 203 (Wyo.) reversed on other grounds.

When Breathing Stops
with
Pentothal and Curare
use the

STEPHENSON



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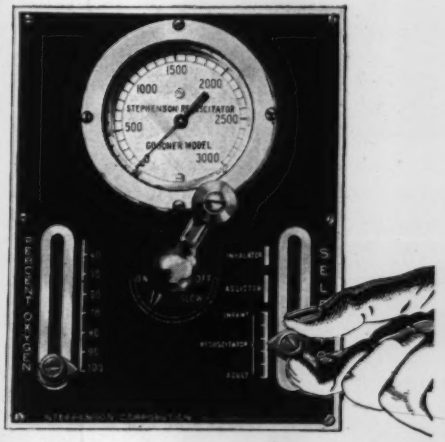

Stephenson Corporation
Red Bank New Jersey

THE NEWS

RECORD CROWD ANTICIPATED FOR FIFTEENTH ANNUAL MEETING

Reservations are reaching a new high for the Fifteenth Annual Meeting of the American Association of Nurse Anesthetists, convening in Atlantic City, September 20-23. There are indications that the attendance will be well representative of all sections of the country, and plans are being made in anticipation of the enthusiastic participation of the members in the convention program.

The theoretical, clinical, and professional aspects of the practice of anesthesia will be integrated at three general session. At the business session on Tuesday, September 21, progress and plans of committees will be reported, and the proposed revisions of the by-laws will be submitted for discussion and approval. Problems common to the national and state associations will be aired at the council session. Each member should be sure to bring her copy of the proposed revisions of the bylaws and her 1948 membership card to the convention. The membership card will be needed for purposes of identification.

At the annual banquet on September 22, the second award of appreciation will be presented.

Schools of Anesthesia Assembly

A morning, an afternoon, and an evening session on Monday, September 20, will be devoted to the problems and plans of the directors of the schools of anesthesia. Educational consultants will be present to discuss educational methods and aids.

FROM THE STATES

The **Southeastern** Assembly of Nurse Anesthetists held its eleventh annual meeting at the Buena Vista Hotel, Biloxi, Mississippi, April 22-24. Officers elected were: Mrs. Boykin Davis, president, and Hilda Singletary, secretary-treasurer. The following program was presented:

"Importance of Trained Anesthetists in the Hospital"
John W. Gill, administrator
Mercy Hospital, Vicksburg, Miss.

"Pharmacology and Physiologic Action of Cyclopropane"
John Adriani, M.D.
Charity Hospital, New Orleans

"Complications during Anesthesia"
Hilda Singletary, R.N.
Emory University Hospital, Emory University, Ga.

"Advantages of Continuous Drip Pentothal Sodium during Spinal Anesthesia for Major Surgery"
Ann Klein Hyatt, R.N.
Grady Memorial Hospital, Atlanta

"Anesthesia in Small Hospitals"
Melba Carmicheal, R.N.
Meridian, Miss.

"The Need for Nurse Anesthetists"
Alton Ochsner, M.D., F.A.C.S.
Ochsner Clinic, New Orleans

"Anesthesia for Neurosurgery"
J. Garber Gailbraith, M.D., F.A.C.S.
University of Alabama, Birmingham

"Recent Advances in Cardiac Surgery"
Charles J. Donald, M.D., F.A.C.S.
University of Alabama, Birmingham

"Anesthesia for Dental and Oral Surgery"
Walter Shannon, D.D.S.
Jackson, Miss.

"The Present Objectives of the American Association of Nurse Anesthetists"
Major Edith Aynes, ANC
Washington, D.C.

The **Tri-State** Assembly of Nurse Anesthetists convened for a three day meeting at the Palmer House, Chicago, May 3-5. Julia Baines was re-elected chairman, and Pauline Henry, vice chairman. Marie Garrity was appointed secretary-treasurer.

The second annual meeting of the **Western States Section** of Nurse Anesthetists was held in conjunction with the Western Hospital Association convention at the Biltmore Hotel, Los Angeles, April 19-22. Officers elected were: Edna Peterson, chairman; Ragna Wigen, vice chairman; Marie Callori, secretary-treasurer. Major Edith Aynes, ANC, and a member of the A.A.N.A. Board of Trustees, presented a paper on "Aims and Goals of the American Association of Nurse Anesthetists." John Dillon, M.D., chief anesthesiologist of Los Angeles County Hospital, showed a film on intratracheal anesthesia and discussed balanced anesthesia. Marguerite Layton of Seattle presented a paper on "The Status of Blood Pressure in Conjunction with Cyclopropane Anesthesia."

At the annual meeting of the **Alabama** Association of Nurse Anesthetists on May 15, the following officers were elected: Bernice L. Walsh, president; Edna E. Nelson, vice president; Helen S. Perry, secretary-treasurer.

The **Arkansas** Association of Nurse Anesthetists met in conjunction with the Arkansas Hospital Association in Little Rock, May 19. Dr. John Adriani, director of anesthesia, Charity Hospital, New Orleans, was the prin-

Mrs. Boykin W. Davis
President, Southeastern Assembly
of Nurse Anesthetists

cipal speaker. Guests of the Arkansas association at this meeting were members of the Tennessee Association of Nurse Anesthetists.

At the annual meeting of the **California** State Association of Nurse Anesthetists at the Providence Hospital Nurses Home, Oakland, March 9, officers elected were: Jane Osborne, president; Marie Callori, 1st vice president; Mary Thornton, 2nd vice president; Marie L. Hebert, secretary-treasurer. Edna M. Peterson was elected to the Board of Trustees.

The **Illinois** Association of Nurse Anesthetists will hold its annual meeting at 3 p.m. on September 1, at the Wesley Memorial Hospital, Chicago. Officers for 1949 will be elected.

At the annual business meeting of the **Indiana** Association of Nurse Anesthetists, held at the Palmer House, Chicago, May 4, officers elected were: Lucille Pohler, president; Helen Roe, vice president; Agnes M. Lange, secretary-treasurer; Marie P. McLaughlin, trustee.

The annual meeting of the **Iowa** State Association of Nurse Anesthetists was held at Hotel Fort Des Moines on April 22. The following officers were elected: Eleanor J. Regan, president; Phyllis A. Roberts, vice president; Carol A. Abbey, secretary; Mary A. Culp, treasurer; Lulu V. Robinson, trustee.

The **Kansas** State Association of Nurse Anesthetists held a dinner meeting at the Shirkmere Hotel, Wichita, May 12. Charles V. Wilson, D.D.S., presented a paper on "Combination of Pentothal and Nitrous Oxide-Oxygen Anesthesia in Oral Surgery." The association voted to have bimonthly meetings.

At the annual meeting of the **Massachusetts** State Association of Nurse Anesthetists, held in Wakefield, May 26, the following officers were elected: Eva McArthur, president; Shina Jarvis, vice president; Rose B. Sbarra, secretary-treasurer; Mildred Taylor and Ruth Richardson, trustees. Daniel Johnson, M.D., physician anesthesiologist at Malden Hospital, presented a paper on tubocurarine.

The **Michigan** State Association of Nurse Anesthetists held an annual meeting on May 15 at Mt. Carmel Mercy Hospital, Detroit. Re-elected to office were: E. Louise Ilgenfritz, president; Ada Snider, 1st vice president; Frances Fanning, 2nd vice president; Ione Wessinger, secretary; Clara Bilyea, treasurer. Lillian Baird was elected to the Board of Trustees. The following program was presented:

"Mechanism of Anesthesia"
Evelyn Cullin, R.N.
Mt. Carmel Mercy Hospital, Detroit

"Anesthesia and Neural Surgery"
E. S. Gurjian, M.D.
Grace Hospital, Detroit

"Intratracheal Anesthesia"
Mary Timmerman, R.N.
Urbana, Ill.

The Alumnae Association of the Grace Hospital School of Anesthesia gave a dinner in honor of Dr. Myra Babcock on

June 5 in the English Room of the Book Cadillac Hotel, Detroit. The year 1948 marks the thirtieth anniversary of the founding of the Grace Hospital School of Anesthesia for the training of nurse anesthetists with Dr. Babcock as director. Eighty-five members and guests were present, coming from as far as Colorado, Alabama, and New York for the occasion. Dr. Babcock received a purse in appreciation for her devotion in the training of nurse anesthetists.

Sister Helen Marie Hughes, director, School of Anesthesia, Mt. Carmel Mercy Hospital, Detroit, read a paper on "Educational Programs in the Field of Anesthesiology" before the Section on Anesthesiology of the Catholic Hospital Association Convention in Cleveland, June 8.

Lucy E. Richards, president of the A.A.N.A., and Florence A. McQuillen, executive director, were guests of the **Minnesota** Association of Nurse Anesthetists at the annual meeting in Minneapolis, June 2-4. Officers elected were: Grace Mirick, president; Ethel Willcutt, vice president; Dorothy Day, secretary; Arline Sandwick, treasurer; Palma Anderson and Ruth Bergman, trustees. The following program was presented:

"Curare"
Stuart C. Cullin, M.D.
University of Iowa, Iowa City, Iowa

"Let's Relax"
Nora Winther, M.D.
Minneapolis

"Anesthesia for the Aged"
Lewis H. Wright, M.D.
E. R. Squibb & Sons
New York City

"Progress in Intravenous Anesthesia"
Joseph W. Baird, M.D.
University of Minnesota, Minneapolis

"Medical Legal Problems"
F. Manley Brist, Attorney-at-law
St. Paul

"A.A.N.A.: Past, Present, and Future"
Lucy E. Richards, R.N.
President, A.A.N.A.
Cleveland

"Trends in Anesthesia"
Florence A. McQuillen
Executive Director, A.A.N.A.
Chicago

Newly elected officers of the **New Jersey** State Association of Nurse Anesthetists are Dorothy N. Ball, president; Alma D. Prykanoski, vice president; Marie A. Bader, secretary-treasurer; Marie Glick, Frances M. Alburger, M. Catherine Horne, Amelia L. Tyler, and Marie A. Bader, trustees.

At the fourteenth annual meeting of the **New York** State Association of Nurse Anesthetists, held at the Hotel New Yorker, New York City, May 11-12, the following officers were elected: Janet D. Cabedo, president; Philomena Dutton, treasurer; Mary Ann Craig, secretary.

The annual meeting of the **North Carolina** Association of Nurse Anesthetists was held at the Washington Duke Hotel, Durham, May 14-15. Members were invited to observe the anesthesia technics used at Duke Hospital. The schedule included

Convention headquarters: Ritz-Carlton Hotel, Atlantic City

intratracheal intubation under topical cocaine and intravenous pentothal anesthesia, use of curare as an adjunct to ethylene anesthesia, control of the level of spinal anesthesia, use of homemade "peace-pipe" for intratracheal ether anesthesia for maxillofacial, neurosurgical, and ophthalmologic procedures. Ruth C. Martin, M.D., presented a paper on "Curare and Curariform Drugs," and Evelyn E. Auld, a paper on "A Rational Prophylactic Regimen for Atelectasis and Bronchopneumonia."

At the annual meeting of the **Utah** State Association of Nurse Anesthetists, held at the Thomas D. Dee Memorial Hospital, Ogden, on April 28, the following officers were elected: Gertrude Erickson, president; Maxine Shadle, vice president; Velta Rogers, secretary-treasurer; Lodema J. Bowman, Mayme C. Garrison, and Viola Redd, trustees.

At the annual meeting of the **Virginia** State Association of Nurse Anesthetists on June 5, the following officers were elected: Harriett V. Ailstock, president; Mary T. Buffey, vice president; Anne Mears, secretary; Christine Cox, treasurer.

RESERVATIONS

Applications for hotel reservations for the annual meeting may be obtained by sending to the Executive Office the form on page 157 of the May 1948 JOURNAL.

NOMINATIONS FOR OFFICE AMERICAN ASSOCIATION OF NURSE ANESTHETISTS

1948-1949

At the fifteenth annual meeting in Atlantic City, September 20-23, the following ballot of candidates for office in the American Association of Nurse Anesthetists will be presented.

PRESIDENT

Myra VanArsdale (Chief Anesthetist, St. John's Hospital, Cleveland, Ohio): Graduate of St. John's School of Nursing, Cleveland; graduate of Lakeside School of Anesthesia, Cleveland; member of A.A.N.A. in good standing since 1933; chairman, Credentials Committee, A.A.N.A.; chairman, Trust Fund Committee, A.A.N.A.; member, Finance Committee, A.A.N.A.; member, Board of Trustees, A.A.N.A., 1944-46; 1st vice president, A.A.N.A., 1946 and 1947.

1ST VICE PRESIDENT

Mabel Courtney (Assistant Director, Grace Hospital School of Anesthesia, Detroit, Michigan): Graduate of Grace Hospital School of Nursing, Detroit; graduate of Grace Hospital School of Anesthesia, Detroit; member of A.A.N.A. in good standing since 1935; past president, Grace Hospital Nursing Alumnae Association, Federation of Catholic Nurses, Michigan Association of Nurse Anesthetists; former chairman, Education Committee, A.A.N.A.; member, Board of Trustees, A.A.N.A., 1946-47; 2nd vice president, A.A.N.A., 1947.

Marie N. Bader (Chief Anesthetist, Glockner Penrose Hospital, Colorado Springs, Colorado): Graduate of St Joseph's Hospital School of Nursing, Philadelphia; graduate of Postgraduate Hospital School of Anesthesia, University of Pennsylvania, Philadelphia; member of A.A.N.A. in good standing since 1939; vice president, Colorado Association of Nurse Anesthetists; chairman, Educational Exhibits Committee, A.A.N.A.; member, Board of Trustees, A.A.N.A., 1946-48.

2ND VICE PRESIDENT

Ruth Bergman (Chief Anesthetist, Northwestern Hospital, Minneapolis, Minnesota): Graduate of Bethesda Hospital School of Nursing, St. Paul, Minnesota; course in anesthesia, Bethesda Hospital, St. Paul, Minnesota; member of A.A.N.A. in good standing since 1934; former president, Minnesota Association of Nurse Anesthetists; member, Revisions Committee, A.A.N.A.; member, Board of Trustees, A.A.N.A., 1946-48.

TREASURER

Exire O'Day (Anesthetist, Ravenswood Hospital, Chicago, Illinois): Graduate of Murray Hospital School of Nursing, Butte, Montana; graduate of Ravenswood Hospital School of

Myra VanArsdale
Cleveland, Ohio

Marie N. Bader
Colorado Springs, Colorado

Mabel E. Courtney
Detroit, Michigan

Gertrude L. Fife
Cleveland, Ohio

NOMINEES FOR OFFICE

Exire O'Day
Chicago, Illinois

Minnie V. Haas
Fort Worth, Texas

Julia Baines
Chicago, Illinois

Josephine Bunch
Portland, Oregon

A.A.N.A. 1948-1949

Anesthesia, Chicago; member of A.A.N.A. in good standing since 1933; treasurer, Illinois Association of Nurse Anesthetists.

Gertrude L. Fife (Cleveland, Ohio): Graduate of Lakeside School of Anesthesia, Cleveland; director, University Hospital School of Anesthesia, 1934-46; charter member, A.A.N.A.; honorary member, A.A.N.A.; editor of *Bulletin*, A.A.N.A., 1933-44; treasurer, A.A.N.A., 1935 to present time.

TRUSTEES

Julia Baines (Chicago, Illinois): Graduate of New England Deaconess Hospital School of Nursing, Boston; graduate of Ravenswood Hospital School of Anesthesia, Chicago; member of A.A.N.A. in good standing since 1937; former president, Illinois Association of Nurse Anesthetists; member, Revisions Committee, A.A.N.A.; chairman, Tri-State Assembly.

Ragna Wigen (Spokane, Washington): Graduate of Gritman's Training School for Nurses, Moscow, Idaho; graduate of Ravenswood Hospital School of Anesthesia, Chicago; member of A.A.N.A. in good standing since 1936; former president, Washington Association of Nurse Anesthetists; member, Nominating Committee, A.A.N.A.; first chairman, Western States Assembly of Nurse Anesthetists.

Josephine Bunch (Anesthetist, Shriners' Hospital for Crippled Children, Portland, Oregon): Graduate of Sacred Heart School of Nursing, Spokane, Washington; graduate of St. Vincent's School of Anesthesia, Portland, Oregon; member of A.A.N.A. in good standing since 1936; first editor of *Onagram;* former president, Oregon Association of Nurse Anesthetists; chairman, Agreements Committee, Oregon Association of Nurse Anesthetists; chairman, Western States Assembly of Nurse Anesthetists.

Minnie V. Haas (Anesthetist, St. Joseph's Hospital, Fort Worth, Texas): Graduate of Methodist Deaconess Hospital, School of Nursing, Rapid City, South Dakota; graduate of Lakeside School of Anesthesia, Cleveland; member of A.A.N.A. in good standing since 1934; former president, Texas State Association of Nurse Anesthetists.

COUNCIL SESSION

4:00 P.M.

Wednesday, September 22

At the Council Session of the annual meeting, officers and members of standing committees of the national and local associations are given an opportunity to present problems for open discussion. All members are invited to attend.

FIFTEENTH ANNUAL CONVENTION AMERICAN ASSOCIATION OF NURSE ANESTHETISTS

ATLANTIC CITY

September 20-23, 1948

Hotel Headquarters—Ritz-Carlton Hotel

All General Sessions and Business Session will be held in Convention Hall, Room B.

PROGRAM

SATURDAY, SEPTEMBER 18
AND
SUNDAY, SEPTEMBER 19

10:00 A.M.—Registration—Traymore Hotel
6:00 P.M.

MONDAY, SEPTEMBER 20

8:00 A.M.—Registration—Registration Desk
12 NOON Convention Hall

9:30 A.M. **Assembly of Directors of Schools of Anesthesia**

Convention Hall—Room B

Esther Myers Stephenson, R.N., Director
Presiding Officer

"Committee Activities and Programs"
Florence A. McQuillen, R.N.
Executive Director

"Problems of the Credentials Committee as Related to the Directors of Schools"
Myra VanArsdale, R.N.
Chairman, Credentials Committee

"The Value and Method of Administering Tests"
Elizabeth L. Kemble, R.N., Ph.D.
National League of Nursing Education

2:00 P.M. **Assembly of Directors**

Convention Hall—Room B

Miriam G. Shupp, R.N., Director
University Hospitals School of Anesthesia
Presiding Officer

"Psychology of the Teaching Process"
George W. Hartman, Ph.D.
Professor of Educational Psychology
Teachers College, Columbia University
New York City

Film: "Endotracheal Anesthesia"
Prepared by I. W. McGill, M.D.
Westminister Hospital, London

"How to Study and Retain Facts"
Goodwin Watson, Ph.D.
Professor of Education
Teachers College, Columbia University
New York City

7:30 P.M. **Assembly of Directors**
Ritz-Carlton Hotel—Trellis Room
Esther Myers Stephenson, R.N., Director
Presiding Officer

Film "Handling and Care of the Patient"
Prepared by I. W. McGill, M.D.
Westminister Hospital, London

"Value and Method of Pre- and Postanesthesia Visits"

"How the Pre- and Postanesthesia Visit Is Done in a School of Anesthesia"

TUESDAY, SEPTEMBER 21

9:00 A.M. **General Session**
Convention Hall—Room B
Lucy E. Richards, R.N., President A.A.N.A.
Presiding Officer

Invocation
Sister Grace Bernardine, R.N., Sisters of Charity Convent, N. J.

Address of Welcome
Lucy E. Richards, R.N., President A.A.N.A.

Address of Welcome from American Hospital Association

9:30 A.M.
"Do Anesthetists Need Liability Insurance?"
Emanuel Hayt, LL.B.
New York City

10:30 A.M. **Business Session**
5:00 P.M. Convention Hall—Room B
Lucy E. Richards, R.N., President A.A.N.A.
Presiding Officer

WEDNESDAY, SEPTEMBER 22

9:00 A.M. **General Session**
Convention Hall—Room B
Dorothy N. Ball, R.N., President
New Jersey Association of Nurse Anesthetists
Presiding Officer

"Then and Now"
Frances Hess, R.N.
Director, School of Anesthesia
Long Island College Hospital
Brooklyn

10:00 A.M.
"Altered Physiology of Normal Body Functions during Anesthesia"
Esther M. Greisheimer, Ph.D., M.D.
Professor of Physiology, Temple University
Philadelphia

11:00 A.M. Subject and speaker to be announced

2:00 P.M. **General Session**
Convention Hall—Room B
Eva MacArthur, R.N., President
Massachusetts Association of Nurse Anesthetists
Presiding Officer

"Anesthesia Studies with the Pneumotachograph"
Leslie Silverman, Sc.D.
Assistant Professor of Industrial Hygiene
Harvard University
Boston

3:00 P.M. Subject and speaker to be announced.

4:00 P.M. **Council Session**

Ritz-Carlton Hotel—Trellis Room
Florence A. McQuillen, R.N., Executive Director
Presiding Officer

7:30 P.M. **Banquet**

Ritz-Carlton Hotel—Trellis Room
Lucy E. Richards, R. N., President A.A.N.A.
Presiding Officer

Invocation
Rev. John G. Martin, S.T.D.
Newark, New Jersey
Administrator, Hospital of Saint Barnabas

Address

THURSDAY, SEPTEMBER 22

9:00 A.M. **General Session**

Convention Hall—Room B

Janet D. Cabedo, R.N., President
New York State Association of Nurse Anesthetists
Presiding Officer

"Cardiac Surgery with Particular Reference to the Treatment of Pulmonic Stenosis"
Alfred Blalock, M.D.
Surgeon-in-Chief, The Johns Hopkins Hospital
Baltimore

9:45 A.M.
Discussion
Olive L. Berger, R.N.
Chief Anesthetist, The Johns Hopkins Hospital
Baltimore

10:30 A.M.
"Physical Principles in Relation to Anesthesia"
Albert Faulconer, Jr., M.D.
Section on Anesthesiology, Mayo Clinic
Rochester, Minnesota

11:15 A.M.
"Influence of Posture and Position on Physiology during Anesthesia and Operations"
Vincent J. Collins, M.D.
Associate Anesthesiologist, Doctors Hospital
New York City

2:00 P.M. **General Session**

Convention Hall—Room B

Helen Young Walker, R.N., Secretary-Treasurer
Pennsylvania Association of Nurse Anesthetists
Presiding Officer

3:00 P.M. Subject and speaker to be announced.
Discussion
Major Edith A. Aynes, ANC
Washington, D.C.

4:00 P.M. Forum

ABSTRACTS

Wolpe, Leon Z., and Birnberg, Victor J.: Analgesia and anesthesia in relation to asphyxia neonatorum. West. Med. & Surg. 2: 103-107, March 1948.

"It has been shown that severe degrees of anoxia produce severely devastating cerebral lesions. Is it not possible that lesser degrees of anoxia will produce lesser lesions? It opens up a whole new field of speculation with regard to the possible cause of such conditions as epilepsy, psychopathic personality and lesser degrees of mental inferiority. . . . The difference in tolerance to medicaments inherent in the newborn and maternal organisms renders inevitable an increased frequency of toxic effect in the more frail infant. The exaggerated susceptibility of the premature infant is recognized . . . . The task of reviving an asphyxiated newborn infant is quite another problem . . . . Ideal equipment is seldom available. Many hospitals possess respirators which are seldom used but lack resuscitators or other resuscitating equipment for the delivery room where constant use may be expected . . . . The asphyxiated baby is in shock and should be kept warm and treated gently.... The establishment of a well-equipped and trained 'life-saving' team is urged for every delivery room. Much doubt yet exists as to whether oxygen or a mixture of carbon dioxide and oxygen should be employed in resuscitative efforts. The concensus is that the addition of 5 per cent carbon dioxide is acceptable. Asphyxia neonatorum still takes a grave toll both of life and intellect."

Eason, Edith, and Karp, Mary: Use of curare in the anesthetic management of the profoundly sedated patient. Am. J. Surg. 75: 695-699, May 1948.

"The study is based on an evaluation of 446 cases; one hundred of these have been subjected to analysis. The sedation in this series comprises two or three injections of morphine and scopolamine . . . . Upon arrival at the operating room the patients were drowsy or unconscious. A large percentage of them manifested an ideal reaction to the drugs . . . . A number of these patients . . . [showed] evidence of cerebral irritation due to the large dose of scopolamine . . . . Another group evidenced a drug imbalance with a preponderance of morphine depression signs . . . . Establishing surgical anesthesia and adequate relaxation in these semi- or completely unconscious, rigid patients proved a hard task with the anesthetic gases available . . . . Since November 1, 1944, curare has been employed in the anesthetic management of these patients . . . . Small divided doses of curare adequately secured the desired muscular relaxation in 93 per cent of the cases studied . . . . The total dose of curare per case was less than the amount required when heavy sedation was not used. No contraindications to this method were noted."

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TEITELBAUM, MYER: The use of ether intravenously in peripheral arterial occlusive disease; a preliminary report. Grace Hosp. Bull. **26**: 3-9, Jan. 1948.

"Recently Katz described the use of diethyl oxide (ether) intravenously in the treatment of ischemic gangrene . . . . Although the actual modus operandi of intravenous diethyl oxide on the circulation is not known exactly, it appears that its action is twofold: 1. It acts directly on the peripheral collateral circulation, effecting a progressive vasodilatation of the arterioles and capillaries, and thus produces an augmented peripheral collateral circulation. 2. It appears also that diethyl oxide abolishes the vasospastic factor by producing a block of the sympathetic nervous system, this block being generalized in its effect rather than a regional one as in a lumbar sympathetic block . . . . We have begun to employ [intravenous diethyl oxide] . . . in occlusive peripheral arterial disease, in both diabetic and non-diabetic patients . . . . Four of the 7 patients were diabetic. Five of the 7 patients had arteriosclerosis obliterans with gangrene and associated toxemia. Intravenous ether provided prompt relief to all 6 patients who had pain, even in the 2 patients in whom a full course of therapy was not carried out. . . . The results are encouraging."

MCNEAL, ALICE; HUTCHISON, NORTON, AND MCLAUGHLIN, LEON DURWARD: Report of the effect of various anesthetics and operative procedures on the venous pressure. South. M.J. **41**: 434-438, May 1948.

"The records of venous pressure as reported . . . were undertaken . . . (1) to test the usefulness of a new and simple recording device for the direct measurement of venous pressure, (2) to record the effect of several anesthetic agents and methods on the venous pressure, and (3) to check the value of such records in anticipating shock . . . . An instrument for recording the venous pressure by direct method has recently been devised by a member of the Bio-Chemistry Department of the Medical College of Alabama. It consists of a two-tube calibrated manometer connected by a rubber tube to a leveling device . . . ."

"Animal experiments have indicated that venous pressure falls earlier than rise in pulse rate or decrease in arterial pressure. Fourteen records are too few to draw any definite conclusions. Although several of these were records of patients in which there was a clinical picture of shock, in none was there significant fall in venous pressure sufficiently in advance of the arterial pressure to be of value in anticipating a severe picture of secondary shock. In fact, these records were those in which the marked rise in venous pressure occurred concurrent with a rapid introduction of blood or blood substitute into the venous system."

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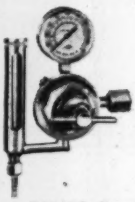
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BOOK REVIEWS

George Crile: An Autobiography. Edited, with Sidelights, by Grace Crile. Cloth. 624 pages, 22 illustrations. Philadelphia and New York: J. B. Lippincott Co., 1947. $10.00.

George Crile was one of the surgeons who lived in the "Golden Age" of surgery. This story of his life is an account of one man's adjustment to the challenge of a new era of rapid growth in a field of science, the development of which holds storybook fascination.

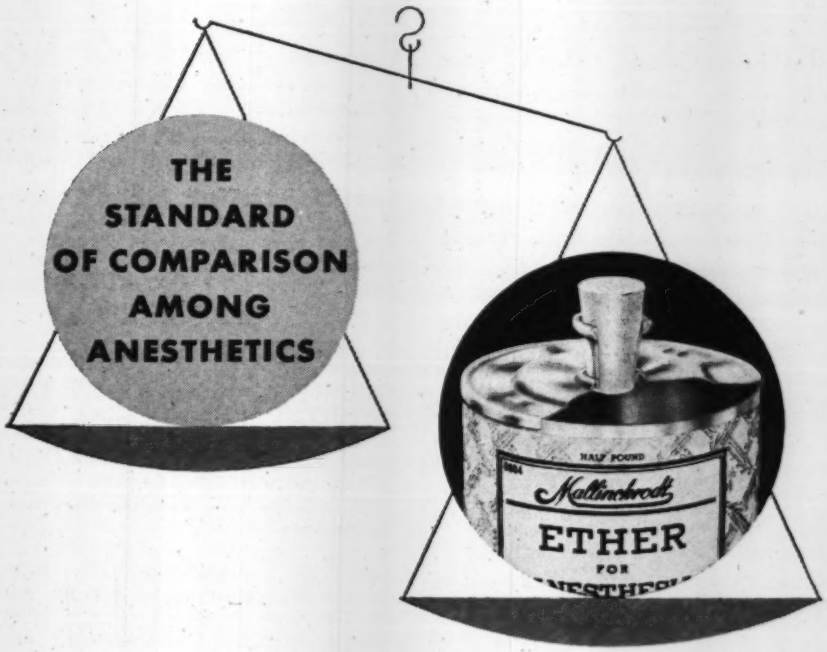
Throughout the story there are threads, woven into his life pattern, which continued from the beginning of his career to the end. Shock, its causes, effects, and treatment; blood transfusion; military surgery; theories of life and the effects of civilization upon disease are only a few of the interests which came under the keen scrutiny and eventually into the writings of this man. Of special interest to anesthetists is the story of anesthesia, which is another thread woven throughout the entire story, beginning with an account of the methods of anesthesia in 1886 when he entered medical school. The development of spinal, regional, and other methods of anesthesia follows in close proximity to the studies on shock. Discussions of nitrous oxide and anoci-association each occupy a chapter (XXIII and XXIV).

The chapter entitled nitrous oxide anesthesia tells the story of how Agatha Hodgins started her career as an anesthetist. From that point through World War I and into World War II, incidents relating the story of the author include the story of the nurses who served as his anesthetists.

Fifteen pages of index conclude the volumes and indicate the many facets of this story of George Crile. In the preface to the book, Grace Crile, who edited the book after her husband's death and added sidelights to his notes, summarized her interest in writing "just as one tries to capture the beauty of the autumn fields by picking a flower here and there, I have selected from my field of memories—the Chief's manuscripts and dairies—sections that I trust may be colorful sidelights on a great and vivid personality."

Surgical Physiology. By Joseph Nash, M.D., Assistant Professor of Clinical Surgery, New York University College of Medicine; Associate Visiting Surgeon, Bellevue Hospital, New York City; Chief of the Surgical Service, 90th General Hospital and Consultant in General Surgery 819th Hospital Center, Bar le Duc, France. Cloth. 496 pages, 16 illustrations. Springfield, Ill.: Charles C Thomas, Publisher, 1942. $6.00.

The title of this book could well include the word anesthesia. Beginning with the preface and throughout the text, the author has recognized the interrelationship of the physiology of surgery and of anesthesia. The first five



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chapters are devoted to subjects of special interest to all anesthetists: circulation, shock, and respiration. Throughout the entire text, the effects of anesthetics on various systems and their functions are stressed.

The Autonomic Nervous System. By James C. White, M.D., Assistant Professor and Tutor in Surgery, Harvard Medical School; Chief of Neurosurgical Service, Massachusetts General Hospital, Boston; and Reginald H. Smithwick, M.D., Instructor in Surgery, Harvard Medical School; Assistant Visiting Surgeon, Massachusetts General Hospital. Cloth. 469 pages, 92 illustrations. New York: The Macmillan Co., 1941. $9.00.

The second edition of this book, now in the fifth reprinting, includes much of the new information which appeared after the publication of the first edition in 1935. To accomplish this without unduly increasing the size of the book, the authors omitted some of the older references, illustrations, and case histories that appeared in the first edition. The history of the anatomy of the autonomic nervous system precedes a detailed description of the subject in the first three chapters. General physiology, physiologic action of drugs and hormones, physiology of visceral pain, and methods of study of physiologic phenomena each occupy a chapter. Part II contains seven chapters in which various conditions that are suitable for sympathectomy as well as those that are not are presented in detail. Part III contains six chapters in which the effects of sympathectomy are discussed. In Chapter XX, Part II, is a discussion of paravertebral injection of sympathetic rami and ganglia. Each chapter is followed by a bibliography. An index completes the volume.

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NURSE ANESTHETIST WANTED: Hospital close to Chicago, 200 bed general hospital, desirable working conditions. M.D. head of department. Write Box 330, Journal A.A.N.A., 22 E. Division St., Chicago 10, Ill.

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ANESTHETIST: Nurse anesthetist wanted for 114 bed hospital; three full-time anesthetists employed; salary $300 with complete maintenance; general hospital, fully approved. Apply to: Superintendent, Petersburg Hospital, Petersburg, Va.

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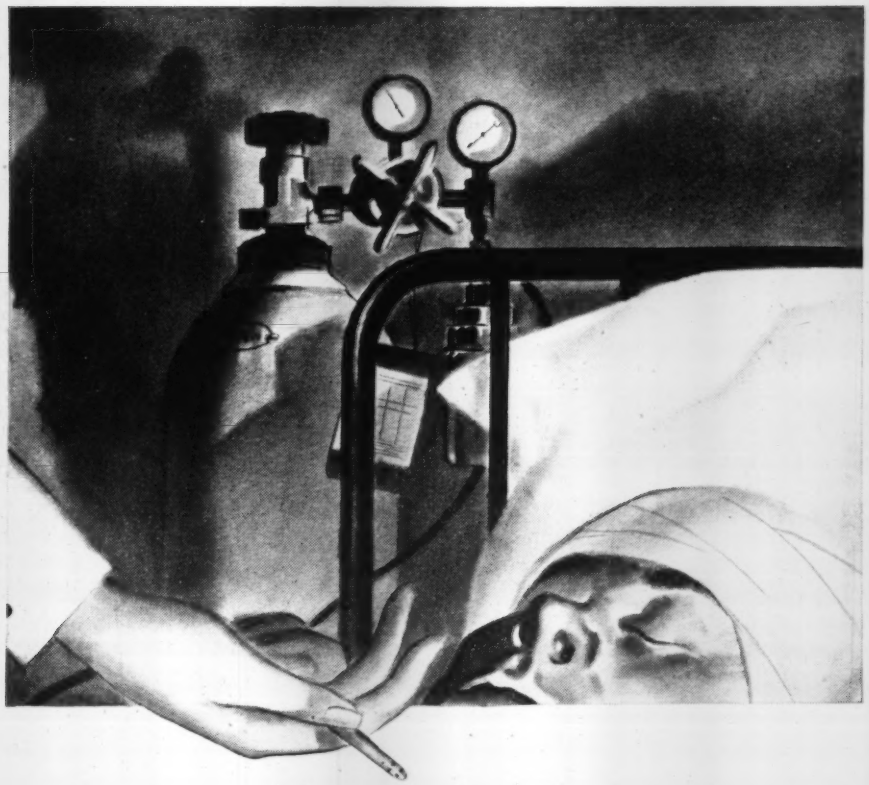

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